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EDITORIAL NOTES—GAS, &c.

Electricity Generation by Gas-Driven Plants.

FIGURES derived from actual practice are always to be preferred to those of theoretical or experimental genesis. Those that are theoretically obtained do not embrace the adventitious losses that occur in practice; and in experimental working, the care and watchfulness exercised preclude those losses arising. We have had many figures published—the plant builders' figures mostly—regarding the working of suction-gas plants; but examination usually reveals that the figures are not the over-all costs attaching to such plants—something, as a rule, is found missing. In this connection, therefore, a paper by Mr. J. F. C. Snell, read before the Institution of Electrical Engineers recently, is of more than ordinary value. In that paper appears a table of the ascertained cost of power per unit of electricity generated by private plants driven by engines—supplied with town gas, suction gas, oil, and steam—of from 20 to 100 horse power. The figures have been collected from users of such plants; and Mr. Snell appears to have taken great pains to ensure that the figures are reliable. They are not merely test figures which afford no real criteria of the commercial working of such plants; but they have a real practical existence and significance. In the calculations, an average price of 2s. per 1000 cubic feet has been adopted for town gas; and in the case of suction-gas engines, the cost of anthracite coal has been taken at 22s. per ton and of small peas at 10s. Water has been charged at an average price of 6d. per 1000 gallons; repairs and lubricating oils at actual figures; and depreciation and interest on capital outlay throughout at 10 per cent.

The price of 2s. for town gas, while perhaps it is giving for the country through about the average figure now charged for town gas supplied for power purposes, is not applicable to a majority of the great manufacturing centres where the charges for power supply are found to be assembled round about 1s. 6d. per 1000 cubic feet, with departures from this upwards to (say) 2s. and a few in the opposite direction, until we get down, in an isolated case or two, to 1s. and even to 11d. When the figures for town and suction gas are contrasted, it is at once obvious that, in the practical working of these private electricity plants, 25 per cent. off the price quoted by Mr. Snell for town gas would make a great difference to the disadvantage of suction gas. With a 10 per cent. load, the ascertained cost of power per unit of electricity, with coal gas at 2s., is 1·423d.; for suction gas under the conditions mentioned, 1·52d. With a 15 per cent. load, coal gas, 1·210d.; suction gas, 1·270d. With a 20 per cent. load, coal gas, 1·090d.; suction gas, 1·040d. With a 25 per cent. load, coal gas, 1·007d.; suction gas, 0·904d. With a 30 per cent. load, coal gas, 0·944d.; suction gas, 0·812d. With a 50 per cent. load, coal gas, 0·791d.; suction gas, 0·625d. With an 80 per cent. load, coal gas, 0·670d.; suction gas, 0·514d. Therefore, for low loads up to 15 per cent., coal gas at 2s. has an advantage in cost over suction-gas plant; and at the higher loads, the value of having gas "on "tap," and being relieved of all capital expense, maintenance charges, and the bother attending the suction-gas plants should be sufficiently appreciated by the manufacturer to induce him to pay a slightly higher price per unit of output than is shown by the suction-gas plant. But this, it must be repeated, is with gas at 2s. Where gas makers can afford to supply at 1s. 6d., the positions in the matter of cost between the two competitors at the higher loads would be reversed. It is pointed out by Mr. Snell that, in nearly every case, there is no proportionate charge in the figures cited for supervision or general establishment charges, or for rating. Between town gas and suction gas in comparison, the objection does not stand for much, though the omission tells more in favour of suction-gas plant than of town gas on tap. The figures, however, are confirmatory of the fact that those gas undertakings that can supply at a low profit-bearing price per 1000 cubic feet can beat suction-gas plant in connection with private electricity generating plants.

But Mr. Snell has got himself into hot water for daring to publish the fact that private electricity plants driven by gas can generate electricity at such low figures. This is not at all to the liking of central station engineers, inasmuch as, when these figures for private plants are put alongside the low and unprofitable charges made for poor loads by many an electricity undertaking, it is seen that even then the private plant scores; and if profitable prices were charged in all cases for electricity, the private plant would beat them hand over hand. The central station engineers have tried to take the polish off the figures. They cannot absolutely deny their accuracy, as they have Mr. Snell's word for it that they are actual figures, and that he took great pains to ensure their reliability. The critics surmise that the private plants are all quite new, and in the best possible condition. But the argument cuts both ways. If private plants depreciate, so do central station plants. There are gas engineers who have been identified with the installation of such private electricity plants—some for driving the scattered machines about gas-works—who can show that it is not always when the plant is brand new, and the troubles of infancy and brief experience are factors detracting from the highest possible results, that the lowest working costs are realized. Another objection of the electricians is that nothing is added to the costs for floor space. We are getting into petty fault-finding here. The figures (more about which, with some examples of electricity charges for power, will be found to-day in our "Electricity Supply Memoranda") have to be contrasted with the bare charges made by electricity undertakings, which charges do not take account of many things appertaining to the electricity supply station. Trifles may have a small effect; but it is a pity for engineers whose own procedure will not stand analyzing to attempt to pick holes in a paltry way. The figures have to be accepted as worth serious consideration; and as much was suggested by Colonel Crompton, in the discussion on the paper, when he said that he knew of a case where a private plant had been put in and worked quite successfully close to a London electricity station. Under such circumstances, while by lip the electricians say (and this denotes their surprise) that they distrust the figures for private plants as offered by Mr. Snell, they realize full well that such distrust as they really possess rests on a more insecure foundation than the figures themselves. There is, however, another aspect of this matter that did not receive prominence in the paper or the discussion. If gas-driven private plants can generate electricity for power at such low figures during the working hours in industrial establishments, so can such plants serve cheaply the large and long-hour consumers of electricity for lighting, who are called upon to bear charges for current altogether out of proportion to the power user.

Electrical engineers are now faced with a combination of circumstances that makes their position somewhat peculiar. For ordinary power supply, they are shown that private generating plants can, given a low price for gas, generate electricity cheaper than the central station can, with its distribution and various other costs, profitably supply at; the metallic filament lamps threaten to reduce revenue from current for lighting; those metallic fillament lamps, if transformers are used and the voltage is reduced to a point suitable for, say, 25-volt lamps, will necessitate increased costs in providing fresh circuits for radiators and other purposes; and in street lighting prices for electricity have had to be brought to such figures on account of complaint of high cost compared with efficient gas lighting that, as in the City of London (*ante*, p. 83), lighting is being done at cost price, and even below if all charges are taken into account. Electricians are aware of all this; but it does not follow that they are looking the matter fairly and squarely in the

face. With a true Micawberian spirit, they are waiting for something to turn up; but for many of them that something will have to approach disaster before they will be disposed to retrace their steps. Their competitors are in better case. They have not, as electricity suppliers have done by the most singular exhibition of juggling that has ever been seen in the world of commerce, reduced their margin of freedom to almost, if not quite to, *nil*; and they can thus face the future without any particular sense of embarrassment.

The Coalite Gas Bill Derelict.

THE proceedings of the Directors of the Coalite Company are as mysterious as ever, and their actions as fickle as our atmospheric conditions. The policy of the promoters of the Company up to the time of the appeal for capital was to hide from the public the little substance possessed to support an unchallengeable existence. Then the public were let into the wonderful secret *viâ* the Patent Office. The Directors then set about purchasing land at what some people consider to be prices altogether out of proportion to value; and upon these lands they proposed to set up carbonizing works. One difficulty in the way of prosecuting the special business of producing coalite (for which, according to the promoters' literature, the whole country was agog) was the profitable disposal of the gas produced; and gas companies working under statutory obligations evinced unwillingness to commit themselves to any uncertain business relations with a Company whose objects and prospects were purely speculative. The Directors of the Company, animated by the uncharitableness of the gas industry, made a fresh move. A couple of months ago, they announced the promotion of a Bill in Parliament in the coming session for enabling them to sell, in the East-End of London, the gas they were hoping to produce at Barking as the result of the pictured extraordinary public demand for a smokeless fuel, the hypothetical yearning of the public for which has considerably shrunk since the promoters of the Company did not finger the whole of the capital they asked for, and since the underwriters became, it is understood, seriously involved. Only two months ago the statutory notices of the Coalite Gas Bill were published, the Bill was printed, and everything appeared in order for it going through, or some stages through, the ordinary parliamentary procedure, when, lo! on Tuesday last, when the Bill should have come before the Examiners for proof of compliance with Standing Orders, there was no appearance. Suspicion being aroused, inquiry elicited the information that the Bill has been withdrawn; but the statement has to be qualified by adding "for this session."

Why this withdrawal? Expense has been incurred up to the present; and the country being (according to company promoters and advertisement articles) so ripe and eager for coalite, surely now is the time, and not the future, for convincing Parliament that the powers sought ought to be conferred in the public interest. Is the explanation of the withdrawal to be found in some working agreement by which the inlet-valves of a Gas Company's holders are to be opened for the reception of the gas produced at Barking? We think not. Rumour over the Company's affairs has been busy, and has not improved the little public estimation the Company had left at the time of the initial steps in the promotion of the Bill. If the Directors of the Company have not made some such arrangement with a Gas Company, the withdrawal of the Bill means a long postponement of active operation so far as London is concerned, and a further postponement of the fulfilment of the sayings of the prophets, and of the realization of the hopes of the shareholders, who, by the aid of the promoters' phantasmagoria, saw boundless wealth at the end of speculation.

Perhaps, however, rumour of a few weeks ago in the City is right, that the condition of the internal affairs of the Company has spread bitterness through the directorate, and that to apply the description of "happy family" to them would be a misuse of terms. To the end of this state of affairs, rumour had attached a cause, and it is that the Board have got into a financial *cul de sac*. We give the information for no more than rumour is worth. It is to the effect that the original Syndicate did most of the underwriting, and that they are not now displaying any willingness to further take up the obligations which the reluctance of the public imposed upon them. It will be remembered that, at the statutory meeting of the shareholders in September last, the Chairman was somewhat vague in his references to the position of the underwriters. He stated that they had to take up some of the shares; that they had already paid a large sum of money; and that he had no doubt they would pay what more was required. Well, report says that the Chairman, if he were replying to the same question now, would have to frame the last part of his answer in contrary manner, and would have to confess that cash at the bank is to-day a necessity rather than a superfluity of the Company. We do not care, as a rule, to rely upon rumour; but the Directors and officials of the Coalite Company have always preferred to cloak their proceedings in mystery, and keep the Press—technical and public—at arm's length, so that we know it is no use applying to them privately for information as to the cause of the withdrawal of their Bill. Therefore, we can only assume there is a probability of this withdrawal and current talk as to a financial tightness through the imputed laxity of the underwriters in providing funds having some intimate association. If it is not so, the Directors are welcome to the use of our columns to deny it, and to support their denial by publishing the names of the underwriters, the payments they have already made, and the amounts for which they committed themselves. We have no hope of the Directors responding to this; but the offer is made for their acceptance or rejection. Meanwhile, they have abruptly removed from the Private Bill programme of the session one of the (to the gas industry) most attractive items. Peradventure they are wise.

An Illuminating Power Test Twice Removed from Modern Conditions.

IT was not a great victory that the Chiswick District Council obtained over the Brentford Gas Company in the Acton Police Court last Tuesday; for it is perfectly easy for anyone conversant with the questions involved to put his finger on the weakness of the success. It was a victory procured by the aid of an antiquated and (according to modern ideas) inefficient test-burner, and an antiquated notion as to the fitness of unrefined conditions in photometrical work. From this aspect of the case, we sympathize with the Company; but we cannot do so from the one which shows deliberate neglect in relieving themselves of the vague testing conditions under which they were placed by the Act of 1868, and which simply stipulated, as was the wont in gas legislation of those days, that the test-burner should (following the wording of the Metropolis Gas Act, 1860) be an argand burner containing 15 holes, and used with a 7-inch chimney. The case against the Company was that on two days specified the gas supplied by them at the Chiswick Town Hall was only of 11·13 and 11·24 candle power, tested by the Sugg-Letheby burner (which is a 15-hole argand as known in 1868) and a 7-inch chimney, while the parliamentary standard illuminating power is 14 candles. The Company, on the other hand, endeavoured to maintain a title, through the openness of the stipulation as to the test-burner to be used, to take advantage, in this matter of testing, of the advances of scientific knowledge in regard to the combustion of gas for illuminating purposes. But the Magistrates held that the indefinite stipulation as to a 15-hole argand and 7-inch chimney referred to conditions as they were known in 1868; and that those conditions must still apply. Therefore they imposed a penalty of £10 on each summons and 100 guineas costs, consenting at the same time to state a case on the points respecting the burner, the question of whether the Chiswick Town Hall is an "official" testing-place, and as to the length of the notice given to the Company by the examiner to the Council—half-an-hour being the notice allowed by a suspicious Council or examiner, who think miracles are within the scope of a Gas Company's performances. These are all matters that may come under appeal; and therefore we will not discuss the particulars as immediately affecting this case.

The proceedings, however, raise the interesting question as to what was the state of knowledge in 1868 in connection with gas photometry, and whether that knowledge was not then of such a disjointed order that Parliament left it open to gas suppliers to use any burner which complied with the simple and flexible stipulation of the Metropolis Gas Act of 1860, that the test-burner employed should be a 15-hole one, used with a 7-inch chimney. What was in the mind of the Legislature cannot be so well judged by people who had no professional existence at the time as by those who had. Mr. Sugg and Dr. Letheby are not with us now; but in the third volume of "King's Treatise on Coal Gas" we have

Mr. R. H. Patterson, one of the Gas Referees at the date the Brentford Gas Act was passed, writing on the subject. He lived in and through the whole of the illuminating power controversy of those years, and through his hands passed every known gas-burner of the period. It is clear, from what he says, that the Legislature at the time had no intention of prescribing any particular burner as a standard—in fact, they had a very ill-defined notion of what was required, and so left it free and open to gas suppliers to adopt what burner they chose, so long as it contained fifteen holes and was employed with a 7-inch chimney. Mr. Patterson wrote, in 1882: "The Parliamentary Committee of 1860 happened "to have before them an argand corresponding to this vague "definition; and the point is to be here observed, as show- "ing the want of knowledge which then prevailed—viz., "that Parliament evidently believed that all argands with "fifteen holes and a 7-inch chimney were, of necessity, alike "as regards the amount of light which they gave when "burning the gas at the rate of 5 feet an hour." There were in those days three or four 15-hole argands, which appear to have been adopted indiscriminately by gas undertakings for testing purposes; and this confirms Mr. Patterson's observation. Further on, the same writer says that "Parliament ought to have taken some particular and suit- "able burner, and then enacted that, so tested, the illumi- "nating power of the gas should be so-and-so. And the "correct, and indeed only possible, explanation of the fact "that Parliament did not proceed in this manner in 1860, "and again in 1868, was that the enormous difference in "burners was not properly recognized, nor the facts of the "case generally ascertained."

Therefore in 1868 (the year the Brentford Act was passed) it is plain there was no specific "standard" burner; and it certainly seems a peculiar thing that any gas supplier should be penalized to-day on the testimony of one of the instruments employed in measuring illuminating value that had not been defined in more conclusive terms than that it should contain fifteen holes. Compare these terms with the refinement of specification to-day. It is a coincidence that in the year the Brentford Act was passed Mr. Sugg introduced his "London" No. 1 argand—a burner that in scientific refinement beat all its predecessors. It was immediately afterwards adopted by the Gas Referees, and it since has been, until the "Metropolitan" No. 2 argand was produced, the specified standard test-burner in all but comparatively few cases. It is clear, however, that the whole fault for the very unsatisfactory and uncertain position in which the gas-testing question at Brentford is to-day is due to the hesitation of the Board to displace the vague conditions of 1868 by something of a modern and specific character, and so endorsing custom. They did some time ago approach the Board of Trade on the subject; but there was fear of the "melt- "ing pot" if the matter was carried further. This probably is the whole secret why the Brentford Gas Company are not doing what the East Hull Company are doing this session—going to the Board of Trade with a Provisional Order, asking that their ancient, indefinite testing provisions shall be set aside, and the modern ones, approved by Parliament and the Board of Trade, be substituted. Nevertheless, the title to this article sufficiently indicates the absurdity to-day of the test in the Brentford Gas Act, even without the considerations advanced in the body of the article.

Encouragement at Tottenham.

Any scheme having for its object the promotion of good feeling among staff and workmen and the increasing of their interest in their work, is deserving of commendation; and therefore it is a pleasure to be able to draw attention to an innovation which has just been made by the Chairman and Directors of the Tottenham and Edmonton Gas Company, in the shape of "Ability Competitions" for their employees. Particulars with regard to the proposal, as well as the first winning paper, will be found in another part of the "JOURNAL." From a notice issued to the staff and workmen by the Engineer (Mr. A. E. Broadberry), it will be seen that, in order to encourage the study of details by all members of the staff and workmen, and give everyone an opportunity of showing what knowledge and ability he possesses, the Directors will give a prize of half-a-guinea for the best paper prepared on subjects which will be set from time to time, and at the end of the year a prize of two guineas for the best aggregate number of marks. It is also pointed out that regard will not only be had to the correctness of the arguments, but also to the clearness of expression, neatness, and spelling. The first subject selected was the "Principles Involved in Atmospheric Burners, and the Effects of Under and Over Aeration;" and the prize was awarded to Mr. P. C. Gardiner, of the Chemical Laboratory. It is worthy of note that the authors of the nineteen papers sent in for this competition represented practically every branch of the business. This fact augurs well for the success of the scheme; and if future prizes are as widely entered for as was the case with the one just awarded, it is safe to say that, in addition to promoting good feeling and interest in the work that has to be done, the competitions will lead to an increased knowledge by the Company's employees on matters connected with the business of gas manufacture and distribution.

Illuminating Truths—The Osram Lamp.

Persistent advertising of misstatements as to the relative performances of the Osram electric lamp and incandescent gas-burners has prompted the addition to our "Illuminating Truths" series of leaflets of one specially dealing with the Osram lamp. As in the case of the six preceding leaflets, the material forming this one is published first in the "JOURNAL," in order that all gas managers may judge whether or not the leaflet will be of any advantage to them in controverting misrepresentation and in educating consumers in the matters dealt with. The other six leaflets are also being brought up to date in respect of incidents illustrating the points advanced.

Train Lighting and Fires.

There is stored in memory the fact that one of our electrical contemporaries some time ago wrote in a style that is fashionable in halfpenny evening papers of the terrible things that had happened through the use of gas lighting on trains. Memory brings to mind some such expressions as the roasting of passengers to death, but an appeal for the facts on which this outburst of sensationalism rested did not produce the facts. Since the excitement on the Metropolitan District Railway on Jan. 8, when in an electric-lighted coach a number of passengers had their composure rudely shaken by an explosion and electric flashing, there have appeared in the Press letters as to the danger of underground electric traffic nowadays. The electrical world has been disturbed by this; and the Board of Trade have published a report on the subject, signed by Major J. W. Pringle and Mr. A. P. Trotter, the Electrical Adviser to the Board, in which the occurrence has been lightened as much as possible. These are points from the report: Below the floor-level the metal pipe carrying the electric lighting wires and a metal junction box were fused. The underside of the timber flooring, immediately above this pipe and junction box, was charred in places. The real combustibles in this fire (if the word may be used) were copper, iron, and brass. Such electric arcs continue until they exhaust or burn themselves out, or until the current is cut off, as was done at Sloane Square. The ordinary method of extinguishing a fire is useless for electric arcs. This particular case was caused in all probability by failure of the insulation of the electric-lighting wires owing to damp. The heating of the wires resulted in the liquefaction of a small plug of bitumen. An explosion of bitumen vapour followed, causing smoke and fumes. Subsequently electric flashing took place along the pipe and at the junction-box under the car. Notwithstanding these uncomfortable experiences, we will not conjure up the terrible things that might happen through such an accident.

The "Socialist-Labour" Party.

The coalition of labour and socialism, and the questions of old-age pensions, with provision for the physically unfit, adequate employment provision for the unemployed out of State funds, State control of wages by the fixing of a minimum for less hours of work, and the abolition of the House of Lords; and there we have in a nutshell the major points of the programme that the 400 or so delegates of the labour party, meeting at Hull last week, have drawn up for immediate prosecution in and out of Parliament. We could afford to pass with a smile the eccentricities of the labour demagogues of the extreme order if it were not that the Government are doing all they can to prepare the ground as much as possible for these wild schemes, while attempting not to give offence to the moderate and more sober-minded of their supporters. But the most significant of all the resolutions passed at the conference was that which expressed the view of a majority of these representatives of over a million workers that the time has

arrived when the labour party should have as a definite object the socialization of the means of production, distribution, and exchange, to be controlled by a democratic State in the interests of the entire community, and the complete emancipation of labour from domination by capitalism and landlordism. That is socialism unadulterated. Many old-established trades unions have refrained from any open profession of socialism. Times, however, are changing. The union of socialism and of the section of labour governed in policy by extremists, has been seen coming closer year after year at the labour congresses. It was only a matter of time for most of the unions to enrol themselves under the red flag, though a minority of their members may not approve. There has been hesitation in taking the final leap. One day last week in Hull, a majority of the delegates of the labour party—most of them leaders and officials in trades unions—declared against socialism; the next day a majority pronounced, amid a demonstration of the wildest order, in favour of the resolution the terms of which are traced above. The proceedings were significant, and force to the front again the inquiry what are the employers doing to counteract the definite progress of socialism? Let them study the terms of the resolution to see whether their interests are involved. If they deem they are, then perhaps the policy of letting things take their own course will forthwith be discreetly abandoned; and co-operative measures between capital and labour be adopted. In these latter, intelligent labour is finding an alternative road to results equally as good as those that the teachers of socialism predict will proceed from the establishment of their doctrines. The Leamington Gas Company have ranged themselves alongside the South Metropolitan, Commercial, South Suburban, Chester, Newport, and Stafford gas undertakings.

Old-Age Pensions and Employment.

The labour party having secured the sympathy of the Government, and promises to forward an old-age pension scheme, have, at this conference, shown their determination to go a step further, by demanding that provision shall also be simultaneously made for the "physically unfit." No question of ways and means troubles the meteoric leaders of the Socialist-Labour party. The spirit in which they deal with these questions is that, "When we ask, we shall see that we receive; and there is an end of the matter so far as we are concerned." The old-age pension is to be a civil right, there is to be no question of charity; and the funds are to come from Imperial taxation. The pension is to be payable at 65, is to be universal, non-discriminatory, and non-contributory. This was the view not long since of the Chancellor of the Exchequer; the other day he faced right-about, and said every class must pay its just contribution. Regarding the "physically unfit," the labour delegates cannot have known what they are demanding, nor of the difficulties that oppose such a scheme. The cost of providing a pension of 5s. a week for all persons over 65 years of age is estimated at between £27,000,000 and £30,000,000; and no one can tell—it is all so much in the air—what addition provision for the physically unfit would impose. But this is not all. An Unemployed Bill is now to be introduced into Parliament, by which responsibility for providing work for the honest unemployed is to be made part of the work of municipal authorities; and the National Exchequer is to pay the great part of the cost of doing this. Poor municipal authorities! What with the affairs of legitimate local government, the management of trading enterprises, and the finding of employment for every person who is put out of work by a season of bad trade, there will be a further loss of administrative efficiency. But never mind, for are not the workmen the wealth producers? Brain, prudence, thrift, commercial ability, and so forth have, we are told, nothing to do with the production of wealth. Labour does it all; and it is the idle rich who benefit the most. This is the mad chatter of the delegates of the Socialist-labour party. Beyond all this, the eight-hour day, one of the delegates assures us, is now too long for oppressed labour. More money, work for all, but reduced to the narrowest possible limits, and no necessity for taking thought for the morrow, with the requisite funds to be provided largely by those who have laboured and saved in the past—such is the Socialistic way to an industrial peace. Such is the way, paved by the several schemes to which we have referred, to the country's bankruptcy, and to the greater distress of labour. Those among us who have the best interests of labour at heart will fight with vigour against revolutionary schemes that must end in disaster.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 249.)

BUSINESS on the Stock Exchange last week proceeded merrily along, with no ugly clouds looming ahead on the horizon, and with the as-good-as-a-certainty of cheaper money. This, of course, more especially affected Consols and the gilt-edged class, for some of the other departments had their own factors at times to reckon with. The opening promised well, and there was pleasing evidence of more activity. On Tuesday, the best lines continued strong; but Railways did not improve. Things continued much the same on Wednesday; and again Railways were the weak spot—on account of dividend announcements, light traffic, and prospects of trade shrinkage throughout the country. Thursday was the best day of the week; the upward tendency being shared by nearly all departments, stimulated by a 4 per cent. Bank rate. But the next day the reverse of the medal was displayed—a regular Friday realizing—and the reaction was almost general. A recovery, however, set in on Saturday; the gilt-edged division having the best of it. Altogether, Consols rose 1⅛ in the week. In the Money Market, there was an ample supply at light rates; and rates for discount eased away steadily. The Bank of England rate was lowered on Thursday to 4 per cent. The variations for the month are worth recording. On Jan. 1, the rate was 7 per cent.; on Jan. 2, 6 per cent.; on Jan. 16, 5 per cent.; on Jan. 23, 4 per cent. Business in the Gas Market was brisk and cheertul, with great buoyancy, several issues making further advances. Cheaper money advanced debenture stocks generally. Gaslight and Coke was pleasurably affected by the announcement that, after paying the dividend, the Company would be increasing their carry-forward by £42,500. Dealings in the ordinary were numerous, and prices marked rose from 97¾ to 99. The maximum was done at 88; the preference at 104¾ and 106; and the debenture at 82 and 83. South Metropolitan was quiet and firm at from 124¾ to 126. Nothing was done in Commercials but one bargain in the debenture at 81¾. In the Suburban and Provincial group, Bromley "A" changed hands at 120, British at 42, Hastings 3½ per cent. at 94 and 95, South Suburban at 120, and Tottenham "B" at 101¼. In the Continental Companies, Imperial was more than usually dealt in, and prices advanced from 179½ to 182 at the close. Union was quiet at 109. European fully-paid was the like at 23 and 23¼; ditto part-paid at 17. Among the undertakings of the remoter world, Buenos Ayres was freely dealt in at close prices ranging between 11 1/16 and 11⅜. Monte Video was marked at 11⅛, Primitiva preference at 5 1/16, ditto debenture at 94, River Plate at from 13½ free to 13⅞, ditto debenture at 93¾, San Paulo at 13⅜, and Melbourne 5 per cent. at 101¾.

ELECTRICITY SUPPLY MEMORANDA.

Power Supply Contrarities, Actual and Journalistic—Suction Gas Plants Denied a "Legitimate Place" in the Ranks of Efficient Power Agents—Private Gas-Driven Plant Costs and Correct Prices for Power Supply—Further Warnings to Electricity Undertakings—Fires and Failures.

THERE has recently been a large amount of space given up by our electrical contemporaries to the question of power supply. The "Electrical Review" mentioned the matter in some observations on "Electrical Finance and Industry in 1907," the "Electrician" devotes its January "Industrial Supplement" to the question; and Mr. J. F. C. Snell (among others) has been lecturing the Institution of Electrical Engineers, in a paper on the "Cost of Electrical Power for Industrial Purposes," upon the errors of the ways of some of the members, the prime purpose of which paper was to carry forward the gospel of centralization. The centralizers have been busy lately; for it was only a few weeks ago that Mr. W. B. Woodhouse was holding forth on the same subject. The "Electrician" Industrial Supplement extolled the progressive spirit of electric power supply; Mr. Snell held up a warning finger, and showed that the progress in power supply is being largely made through a slipping away from financial soundness, and yet electricity must be supplied at a still cheaper rate if it is to hold its own! He showed clearly that electricity can be, and is, generated by private plants driven by town gas, suction gas, oil, and steam at prices below what should legitimately be charged by many an ordinary electricity supply undertaking, although he took town gas at 2s. per 1000 cubic feet, and said nothing about those numerous towns in which gas, high in B.Th.U.'s, for power purposes (the gas supplier cares not a jot whether the manufacturer uses the gas for generating electric current or for motive power in a direct manner) is being supplied at pence below 2s., even down in one instance, to 11d. If Mr. Snell had taken some of these lower figures—say, round about 1s. 6d.—he would have seen that there is good reason for both electricity stations and suction-gas plants regarding town gas as a puissant opponent.

The "Electrical Review," we are pleased to note, does not treat the competitors of electricity as having no right to exist. Of course, mature experience and judgment should be good aids to steering clear of fatuity. Our contemporary, glancing over the past year, says that it remembers "the development in suction

gas plants robbing public supply circuits of good power consumers, and leading to a readjustment of power charges (as at Bradford) in the hope of retaining present consumers." That is sensible recognition. But hearken to, and compare with the foregoing, these sentences culled from the "Electrician" Industrial Supplement: "It must be evident, from the progress made in the application of motors to the driving of industrial machinery, that steam, gas, and oil engines are not only *no longer required*, but are absolutely *undesirable* as adjuncts of industrial undertakings situated within range of large electric power houses. The suction-gas plant and the high-speed oil-engine have a distinct mission to fulfil in places remote from transmitted and distributed electric power. In towns and manufacturing centres where already electrical energy is 'on tap,' the suction-gas plant, no matter what its claims to phenomenal economies may be, has *no legitimate place* in the ranks of efficient power agents." We are not particularly in love with the suction-gas plant ourselves; but from what we know of it the suction-gas plant will doubtless decline to submit to confine itself to any position arbitrarily allocated to it by the writer of "The Progressive Spirit of Power Supply," or to be branded as an illegitimate in "the ranks of efficient power agents." Observe the plural terms "ranks" and "efficient power agents." But as we read on, it is plain that, in the mind of the writer, there is only one god, and the Industrial Supplement is its prophet. Why on earth do not central station engineers drive their own plants by the most "efficient of power agents?" There is surely nothing standing in the way, seeing that "the case for the high-capacity electric motor, and its superiority over the as yet better known gas and steam engine has been conclusively proved." But when we look at the returns from Bradford, Chester, West Hartlepool, Halifax, Nottingham, Hull, Brighton, Edinburgh, Sheffield, &c., the high-capacity engines are conspicuous by their absence—the bulk of the horse-power figures per motor being represented by single ones or low double ones; and we search in vain for any indication in the returns that machines of "above 100-horse power output are becoming more common every day." We admire the modesty that has kept this boom in high-capacity electric motors in the dark. But while it is proceeding, a moment or two might be spared to note that, in truth, the "progressive spirit" has not operated all on one side, as Mr. Snell's figures for town gas and suction gas driven plants testify.

Large central power stations must have an amplitude of custom to enable them to exist while supplying energy at a price sufficiently low to allow them to compete with other forms of power. Districts where congeries of industrial establishments requiring power are to be found, without incurring in the case of electricity enormous costs for distribution expenses and losses through scattered custom, are really comparatively few; and therefore in the greater part of the country, the competition must continue between the local electricity undertaking and other forms of power. Mr. Snell, however, distinctly shows in the tables in his paper that local electricity undertakings (if proper charges are made) cannot possibly compete with private electricity plants driven by gas-engines, when the price of gas is 2s. or under. In the first table he gives the ascertained cost of power per unit of electricity generated for independent installations up to 100-horse power, using town gas, suction gas, oil, and steam. We will consider here the town gas only, at a price of 2s.; and inasmuch as, in numerous towns, gas for power purposes is now being supplied at 1s. 6d. per 1000 cubic feet, or just below and above, the difference in these cases between actual charge and the 2s. more than annihilates the complaint that, though the figures quoted are real ones with which manufacturers debit themselves, "in nearly every case"—not all—there is no proportionate charge for supervision, or general establishment charges, or for rating. It is interesting to see this complaint made, and taken hold of with alacrity by municipal station engineers, who surely cannot without blushing, find fault with private manufacturers on this score. Mr. Snell takes an average load-factor at stages from 10 to 80 per cent., and the ascertained cost of power per unit generated by a private plant up to 100-horse power, using town gas at 2s. is: With a load-factor of 10 per cent., 1·423d.; 15 per cent., 1·210d.; 20 per cent., 1·090d.; 25 per cent., 1·007d.; 30 per cent., 0·944d.; 50 per cent., 0·791d.; 80 per cent., 0·670d. It is an easy matter to find out what these figures would represent at 1s. 6d., or other lower price than 2s., per 1000 cubic feet. But the figures quoted satisfactorily answer the purpose now in hand, which is to show that, according to Mr. Snell's computations, ordinary electricity stations cannot, if they make paying charges, compete with private plants driven by 2s. town gas. His seventh table declares this in a transparent manner:

Comparison of Actual and Correct Charges for Power by Local Authorities and Companies.

	Actual Charge. Pence.		Correct Charge. Pence.
Bermondsey Borough Council . . .	2·060	..	1·792
City of London Company	1·700	..	1·554
Fulham Borough Council	1·000	..	2 024
Metropolitan Company	2·460	..	2·093
St. Pancras Borough Council . . .	1·000	..	1 838
South Metropolitan Company . . .	1 048	..	2 367
Stepney Borough Council	1·000	..	1·549
West Ham Borough Council . . .	1·234	..	1 340
Westminster Company	1·830	..	2·404

From which it will be seen, assuming an average load-factor of 20 per cent., that the actual charge in most cases is above the figure worked to by private plants with gas at 2s.; and several are much above the figure after the correction made by Mr. Snell. This is satisfactory testimony coming from an electrician of recognized standing.

In the "Electrician" Industrial Supplement, it is said that the records of the past year show that electric power supply is being regarded from "a serious commercial standpoint." It is doubtful, on these figures of Mr. Snell and the amassed evidence of the past two or three years, whether central station engineers are "seriously" considering this matter from a "commercial" standpoint. Mr. Snell condemns in anything but a hesitating way what others have condemned before him—the "rash speculative prices" at which power electricity is being sold by many electrical undertakers, especially in London; and he advises a more rational system of charging. What is being done in this way, he categorically says, is only possible through the possession of more profitable consumers for lighting. There is feeble and indefinite repudiation of the accusation, but no robust defence. The experience already of certain London undertakings should check their further descent towards financial instability. If their own experiences are not a sufficiently impressive caution, then they are not wanting friends to utter the emphasizing word. Mr. Woodhouse and others were doing so recently; Mr. Snell does so again in this paper. The present system, he remarks, may do very well where there is only a small amount of power to be given, and where the proportionate revenue is only a small fraction of the gross receipts involved. But "let there be a big increase in the amount of power supplied at the same rates and (despite its effect in the general reduction of generating costs), it will then be found that the total receipts are not commensurate with the total costs; and the result will be an unsuccessful undertaking." Not less emphatic is Mr. J. H. Rider, who, in the discussion, described it as of rather a common occurrence for a lighting station with a poor load-factor to try and encourage the power load by offering a very low price, and to make up whatever loss there might be from the power supply by charging a higher price for private lighting, and more often for street lighting, particularly when the station belonged to a municipality which was also the street lighting authority. If, he added, an undertaking had a lighting load which was bringing in a return, and a power load which did not pay, that power load might increase until the undertaking was in the Bankruptcy Court. The pity of it all is that these warnings do not reach the proper ears—being made at professional meetings, and accorded an ultimate resting-place in the technical journals. The station engineers dare not, for reputation sake, confess to giving erroneous advice. Ringing in their ears are Mr. Raworth's words "Hope on; hope ever" (*ante*, p. 85). The Council chambers and the Board rooms are the places where the warnings should be repeated; so that, if wisdom were allowed to prevail, a check might be put by those in supreme authority upon happenings such as were witnessed in 1906-7 in connection with the West Ham Electricity Department, which department is now making frantic efforts to improve the lighting load, by spending money on cables in new streets, and by addressing to the householders the remarkable circular upon which comment was passed here last week. But while the "progressive spirit" has carried some undertakings on to a road along which there are threatenings of disaster through unremunerative prices, users of power have not to any great extent taken advantage of those prices. During the preparation of evidence in connection with the London County Council Electricity Bills, Mr. Snell and his colleagues ascertained that, in the area of Greater London alone, there are factories utilizing altogether some 400,000-horse power; the evidence for the Administrative Company in 1906 put the figure at 535,742-horse power, of which only 29,053-horse power was then supplied from electricity undertakings. That is not a big result from the "rash speculation;" but it is big enough to have had a very bad effect.

If there is one argument of more importance than any other against the centralization of electricity generating plant it is the increased danger of deprivation of supply over extensive areas. Electricity generating stations have made a bad record, already this year. Twice within about a week have important districts in Paris been put to immense inconvenience by accidents at the Clichy and Central Markets generating-stations. Two dynamos were involved in the accident on Friday week at Clichy; and on Thursday last, it was a big fire that caused a great sacrifice of valuable machinery, and put in darkness the Hotel de Ville, the Place de Châtalet, the Avenue Victoria, parts of the Rue de Rivoli and of the Avenue de l'Opera, and Central Markets. It was a big and obstinate fire; and Paris correspondents report a loss of quite, if not exceeding, £40,000. The flames burst out suddenly in half-a-dozen places about the building; and the electric light was extinguished almost immediately. In the Clichy electricity station, the work of repair had to be carried out by candle light; and in the streets surrounding the Central Markets, the police and firemen had to work by the aid of tar and petrol torches. How hath the mighty fallen! Shops, cafés, streets, hotels, and private residences, suffered on both occasions; and candles became precious in the sight of proprietors and householders. Hull has had two breakdowns of the electric supply lately—one on Jan. 14 being due to failure and burn-out of the 2200-volt armatures of three machines at Sculcoates Lane station. The burn-out caused a cessation of supply throughout

the greater part of the centre of the town for a full half-hour in the early part of the lighting period. There has also been a fire recently at the Sheaf Street generating station of the Sheffield Corporation; but it is understood in this case there was no interruption of supply. While on the subject of failures and fires, a correspondent of an electrical paper has written protesting against the circulation of a pamphlet extolling the virtues of an electric fire preventer. The pamphlet contains a beautifully ideal picture of about 12 inches of flame playing round a piece of flexible cord. "Why" asks the correspondent, "should electrical people, after two decades or more preaching the safety of electric lighting, send out circulars talking about means of preventing electric fires?" Ah! why indeed? Anent the paragraph that appeared last week, on the lighting of Westminster Abbey, another correspondent suggests that electricity should assuredly displace gas if only on the ground of "safety" alone. Better not again emphasize that word by italicizing it. Why, the electrical people cannot guarantee the mansions round about Hyde Park Corner freedom from damage and inconvenience. Sunday evening witnessed a series of explosions in Hamilton Place. A short-circuit in a switch in a distributing-box in that aristocratic place commenced lively times; and a slight fire was caused at No. 2. Immediately this had been dealt with, there was a second and more serious explosion under the pavement immediately outside the mansion of Mr. Leopold de Rothschild; and the force of the explosion wrecked the doors and windows in the basement. Then there was a third explosion at another manhole from which a tongue of flame some 12 feet high shot up in the air. Not till the electric current was cut off was there peace in the neighbourhood; and Hamilton Place had to be content on Sunday night without the so-called safest and most reliable of all illuminants.

Professor Adams on Gas-Stoves, Fogs, and Coalite.

It is gratifying to notice that Professor Henry Adams, in his Presidential Address to the Institute of Sanitary Engineers, made some appreciative remarks about the use of gas-fires. To quote one sentence: "Gas-fires for heating are already widely adopted for offices, consulting-rooms, drawing-rooms, and other rooms where a fire may be required at short notice. I have had nothing else in my offices for the last thirty years, and do not find any of the ill-effects ascribed to them." But the same gentleman is not in favour of the use of gas-radiators and flueless gas-stoves without proper and adequate ventilation; and those who have the best interests of the gas industry at heart will not disagree with him. Radiators and other flueless gas-stoves are suitable for use in halls and passages and other places where there is sufficient natural ventilation. The smoke problem was touched upon in the same address; and in connection with this matter Professor Adams gave a few particulars with regard to the number of foggy days in the Metropolis during the past fifteen years. The month of December is credited with 143 days, October with 132, January with 131, November with 117, and February with 84; but the densest fogs have been experienced in November and December. We are also told that during the black fog on the 20th of November last the atmosphere in West London was found to contain 2½ times its normal volume of carbon dioxide. A paragraph on Coalite gives a few particulars of its manufacture, which process, as most of our readers know, is identically the same as that evolved by the pioneers of the coal-gas industry. We read that it is "stated on good authority" that this new (or shall we say "ancient"?) form of coke lights readily and burns vigorously, but absolutely without smoke. Reference is also made to the use of tar as an efficient preventive of dust on our roadways. For this purpose tar, whether in its crude state or in some prepared form, has undoubtedly made a lasting impression on road authorities, and proved its superiority over any other preparation; and it is now only a matter of time before gas undertakings feel the effects of what should eventually prove to be the means of reducing the existing enormous over-production of tar. When the time comes, this intrinsically valuable product will command a price more in accordance with its true value. With a brief mention of "lead wool" as a substitute for molten lead in making lead joints for gas and water pipes—an improvement to which is ascribed some saving in the outlay for material and a considerable reduction in the cost of labour, with a better result—Professor Adams closed his interesting address.

The "Chemiker Zeitung" for last month contains the concluding portion of a paper by Professor A. Elbner on the use of coal-tar dyes for painting. According to an abstract in the "Chemical Trade Journal," he contends that artificial and synthetic colouring matters are, in many cases, quite as permanent as natural ones, if they are not even more so; but great care has to be taken in selecting and testing them. In the case of natural colouring matters, the most suitable materials and methods of use have been ascertained by centuries of experience; but in the case of new materials provided by modern science, careful experiments must be carried out in order to test them. The author gives directions for determining the resistance not only to light, but also to oil, water, lime, and other agencies. His own experiments indicate that in very many instances artificial colouring matters are superior to those obtained direct from vegetable sources.

PERSONAL.

Mr. F. D. Richmond, who has been Engineer and Manager of the Heckmondwike Gas Company since August, 1904, has been appointed Secretary in addition, as from the 1st inst.

Mr. W. Pomeroy Hickey, the Chief Clerk in the Secretary and Accountant's Department of the Reading Gas Company, has obtained an appointment with Messrs. Krabbé, King, and Co., of Buenos Ayres, and on Thursday last he was presented with a travelling clock, subscribed for by the combined staffs of the Secretary and the Engineer. In making the presentation, the Secretary said Mr. Hickey had been in the service of the Company for seventeen years, and was held in the highest esteem by his brother officials. In the unavoidable absence of the Engineer and Manager (Mr. Douglas H. Helps), the Assistant-Engineer expressed the good wishes of the engineering staff, and their hopes that Mr. Hickey would have the best of health and fortune in his new appointment. Mr. A. B. Stedman has been promoted to the position of Chief Clerk.

OBITUARY.

By the death of Alderman David Jones, J.P., which occurred at Cardiff on Sunday, the 12th inst., in his 76th year, after only a few weeks' illness, the borough has lost a former Mayor and the burgesses one of their most active municipal representatives. It was largely due to his enterprise and foresight that Cardiff is possessed of its present water supply; and he was Chairman of the Water Committee from 1885 until last year. In April, 1898, the Town Council conferred upon him the honorary freedom of the borough, in recognition of the distinguished services he had rendered to his native town.

The Hastings and St. Leonards Gas Company have lost a much respected official by the death, in his 65th year, of Mr. Matthew Hooton, their Chief Foreman, which took place at his residence at Bexhill on the 16th inst., after an illness extending over about sixteen months. Mr. Hooton went to Hastings twenty years ago, after filling responsible positions in the gas-works at Salford and Sheffield. On leaving the former place, he was the recipient of a handsome timepiece from his fellow-workmen; and at Sheffield he was presented with a gold watch. Deceased leaves a widow; and his son holds a responsible position at the Glyne Gap works of the Company. The funeral, which took place last Wednesday, at the Hastings Borough Cemetery, was attended by about sixty of those connected with the gas-works at Hastings and Glyne Gap, including Mr. Charles E. Botley, the Engineer and General Manager, and Mr. C. F. Botley, Assistant Engineer.

We regret to record the death of Mr. F. E. Harris, the Comptroller of the Metropolitan Water Board, which took place suddenly on the morning of Monday, the 20th inst., in his 44th year. Deceased, who was a native of Stratford, was educated privately, and had been a public official during the whole of his business career. For nine years he filled successive offices under Mr. Fred. E. Hilleary, M.A., LL.D., the Town Clerk of West Ham, where he held the positions of Borough Treasurer, Superintendent Assistant Overseer, and Treasurer to the Asylum Committee, all of which he resigned on his appointment as Accountant to the Board just four years ago. A few months later he was made Comptroller. He established and organized the Financial Department of West Ham; and several important appointments to public offices have been made from the staff he trained. He was a Past-President, Treasurer, and Secretary of the Incorporated Institute of Municipal Treasurers and Accountants—the chief examining body in municipal accountancy; and he was also a Fellow of the Royal Statistical Society and of the Society of Accountants and Auditors. The funeral took place on Thursday, at Elmers End Cemetery.

Proposed Standard Notation for Engineering Formulæ.—The Council of the Civil and Mechanical Engineers' Society are taking steps in the direction of standardizing the symbols used in engineering formulæ of every class; and at a recent meeting of the Society the subject was discussed at some length. We learn from a report of the proceedings which we have received from the Secretary, that a number of influential gentlemen engaged in scientific pursuits have expressed their sympathy with the object aimed at, and on the occasion referred to letters were read from several. Among them was Professor Burstall, of Birmingham, who said he thought it most desirable to use certain symbols for certain quantities, and had done this for a good many years in his lectures. The result of the discussion was the passing of the following resolution: "That, in view of the desirability of adopting as far as possible a standard notation and nomenclature for engineering formulæ, this meeting of the Civil and Mechanical Engineers' Society requests the Council to approach the Engineering Standards Committee, the Universities having engineering faculties, the leading engineering institutions, societies, and associations in the British Empire, with the object of bringing about concerted action in the matter, or take such steps as may, in the Council's opinion, best conduce to this end."

THE POSITION OF GAS LIGHTING IN THE UNITED STATES.

Our contemporary the American "Illuminating Engineer," with possibly every wish to hold the balance fairly in discussing competitive lighting industries, has nevertheless courted keen criticism in venturing to suggest that gas lighting in America is being driven to the wall by electricity. The assertion was made in an "editorial" appearing in the October issue; and though the decadence was indirectly attributed to lack of energy on the part of gas administrators, no complaint on this score could be made with the refutation which was speedily advanced by Mr. W. H. Gartley, at the November meeting of the Philadelphian Section of the Illuminating Engineering Society.

Our contemporary follows with a further leader on the subject in the December number, and, after traversing the field in question, adds an interesting confession of faith. The "Illuminating Engineer" in its article propounds the query "What is to be the position of gas illumination in the near future?" This is asked in view of the opinion, evidently held by the writer, that gas lighting is going to the wall, or at least is being driven into a second-rate position. The opinion is only expressed in connection with gas lighting in the United States, for reference is made to the fact that gas as a luminant more than holds its own in Great Britain and other parts of Europe. The alleged American decline is attributed to the conditions which govern the financial world rather than to the relative merits of the rival lights. Combination of gas and electric interests is rendering competition impossible; and where such combination has taken place, economic conditions favour the largest possible use of electric current for lighting, with a corresponding diminution in the use of gas lighting. The "Illuminating Engineer" had on a previous occasion (July, 1907, issue) referred to this influence. Attention was then drawn to the fact that in England gas was "still at the head as a light source"—a position held by virtue of competition "maintained at its highest pitch," through the absence of gas and electric company combinations.

In the working of the joint concern, electric light would appear to be generally offered for lighting purposes, and gas for cooking and heating; and the average American being too busy to argue and investigate in minor matters, simply accepts what is offered to him. The argument is further advanced that reliance solely on the score of cheapness has helped to force gas into the second rank as a luminant. The writer of the article remarks that, "to brand a commodity as 'cheap' is to 'queer' it in the eyes of the ordinary American. As a matter of fact, there is scarcely a single case of electric lighting, in which equally good results, so far as illumination goes, could not be produced by gas, and in most cases at far less cost. But to light with gas is to use a 'cheap' illuminant; and the American will have none of it." For this condition of things, the "Illuminating Engineer" thinks gas administrators are to blame, since in their complacent reliance on a low-priced commodity they had allowed electricians to score with artistic and pleasing effects when introducing their illuminant.

Our contemporary has on several occasions emphasized the importance of the artistic in gas lighting schemes. Its remarks have indeed at times conveyed the impression that Americans are much behind Europeans in this matter. In one editorial, the American "fixture" manufacturer was exhorted to wake up to possibilities in the direction of good design; and he was given as an example the European maker, who, "keeping up with the procession," was producing fixtures which artistically equalled the best efforts in electric fitting design. The "Illuminating Engineer" now certainly makes a strong innuendo of inefficiency and lack of enterprise when suggesting that "unless better generalship is shown by the gas interests so far as lighting is concerned, they are destined to dwindle into a mere horde of camp followers, picking up such discarded bits of lighting as the electrical interests may see fit to leave in their trail." The writer then goes on to say that there was not to his knowledge "a single independent gas company at the present time employing an illuminating engineer, or that seems to have grasped the fact that illuminating engineering is a force to be reckoned with;" whereas the electrical interests had been alert to the importance of the science from the very beginning.

It was scarcely to be wondered at that such an article would bring the more progressive American gas engineers into battle. Mr. W. H. Gartley, of Philadelphia, took the earliest public opportunity of vigorously denying that the gas business was going into a state of decadence. There had been, he said, here and there a municipality that had mixed politics and business, to the detriment of the latter; but the same was true in the case of the electric lighting industry. Philadelphia was cited as an example of what gas engineers were doing. There, in ten years, the sale of gas for illumination had doubled, and the use of gas for other purposes had advanced briskly. Some recent American statistics appear to corroborate Mr. Gartley's contention; and if there was any justification for the suggestion of lack of enterprise in gas matters, this is either passing, or applies only to certain districts, for the American gas industry is during the present decade rapidly progressing. It would seem that during the five years from 1900 to 1905 the manufacture of gas rose from 67,093 million cubic feet to 116,501 millions—an increase of 73½ per cent. The gas consumption per head of the population of the six leading cities in the United States is said to be 7017 cubic feet per annum, which is no mean figure to achieve, as will be found by English gas managers who choose to work out their own makes on the same basis.

The assertion of the "Illuminating Engineer," however, only refers to gas lighting; there being no suggestion that the cooking and heating branches were neglected. On the contrary, it is remarked that the entire energies of gas companies had been diverted to the latter, to the relative neglect of the former. It must be confessed that American gas engineers themselves have frequently conveyed the impression that they made the stronger feature of their cooking and heating development; and in certain directions—such as street lighting, high-pressure lamps, prepayment meter supplies, &c.—it has been admitted by one prominent member of the American gas industry that no progress had been made comparable with that in Europe.

However, to return to Mr. Gartley, that gentleman in speaking to the Philadelphia Section sought to make it clear that no good could accrue to the Illuminating Engineering Society by a depreciation of one of the co-related lighting industries, and suggested that a better spirit would be engendered if it were generally recognized that the demand for artificial lighting covered a field that possessed plenty of room for both industries. Whether the speaker's interpretation of the spirit of the article in question was right or wrong, he evidenced the natural determination of gas engineers that their industry should be considered on equal terms, at least, with their chief rival; and his remarks will probably serve as a useful hint to that end in these days of societies and magazines devoted to the general science of illumination as such.

The "Illuminating Engineer," although suggesting a good deal of apathy in gas lighting enterprise, can scarcely be said to have belittled the possibilities of the gas industry; and in the rejoinder the writer makes this evident by formulating some articles of faith which should carry comfort to those readers of the magazine who are connected with the gas profession. The position of the "Illuminating Engineer" as to gas lighting is clearly stated to be as follows:—

> In quality of illumination, including colour, ease, and comfort to the eyes, facility in distribution, and general utility, gas light is the peer of any illuminant at the present time.
>
> With the exception of elaborate and expensive installations, modern gas-burners are susceptible of as artistic effects as electric lamps.
>
> Its relative cheapness is a full offset to the greater convenience and less proportion of heat of the electric lamp.
>
> The manufacturers of gas-lighting apparatus have kept abreast of progress to an extent unsurpassed by the manufacturers of electric lamps.
>
> The fixture manufacturers have devoted what energies they have in the way of progress entirely to electric lighting; leaving gas lighting in the condition in which it has existed for the past 100 years.
>
> The gas companies have made almost no effort toward educating the public in regard to modern methods and possibilities of gas lighting; and in view of the systematic and vigorous efforts of the electric interests in this particular regard, gas lighting is being superseded by electric light to an extent entirely incommensurate with the relative advantages and disadvantages of the two illuminants.

In the first four paragraphs of this "Credo," there is the *amende honorable* for those who conceived the original article to be an attack upon the gas engineering profession. In the remaining paragraphs, the "Illuminating Engineer" virtually sticks to its guns in the assertion that the commercial branch of the gas industry is not pushed with the same energy as is its competitor. Our contemporary claims to be in touch with nearly all American gas companies of prominence, and declares that those who have adopted the up-to-date methods of the majority of electric light undertakings are in the minority.

Broadhead's Pressure-Reducing Apparatus.

When a service reservoir is situated at such a level that the supply of water is furnished at too great a head over a portion of the distributing system, some form of pressure-reducing apparatus becomes necessary; and the choice lies between the provision of a tank by which the extra head is taken off, and the fixing of a reducing-valve at the point where the lowering of the pressure is required. The chief points in favour of the latter plan are a saving in the initial outlay, as well as in the cost of excavating, fixing, and labour. A new arrangement of reducing-valve, which has been patented by Mr. Broadhead, embodies a new principle to which attention may be directed. It consists in the valve being closed by the inlet pressure; the admission of this pressure being controlled by that on the outlet side. It is claimed for the new system that it permits of the combination of accurate and reliable performance with simple and durable design, and possesses the following advantages: The variation of the pressure on the inlet side does not affect the reduced pressure on the outlet; no creeping up of pressure is possible on the outlet side, as the valve is absolutely tight after the reduced pressure is attained, and this pressure may be varied by an alteration of weights; there is no waste—all exhaust water being displaced into the outlet side of the valve—and no expensive bye-pass pipes and valves are required; in the event of fire, the full pressure of water can be readily made available. The valve is manufactured by Messrs. Blakeborough and Sons.

GAS PROVISIONAL ORDERS FOR 1908.

HAVING completed our *résumé* of the provisions of the Gas Bills that are being promoted for the new session of Parliament, attention may be turned to the Gas Provisional Orders.

The draft of the Order that the Caldicot and District Gas Company, Limited, have laid before the Board of Trade defines the limits of supply, and suggests an authorized capital of £7000, and one-third borrowing powers. For works, lands are scheduled which may be taken on lease or acquired by agreement, with additional lands for purposes other than manufacture up to 5 acres. The standard illuminating power of the gas to be supplied is placed at 14 candles, tested by the "Metropolitan" argand No. 2 burner, with the Harcourt 10-candle pentane lamp. The proposed price of gas is 6s. per 1000 cubic feet. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Earby and Thornton Gas and Lighting Company, Limited, are asking for authority to raise further share capital to the amount of £15,000, provided that the share capital of the undertaking shall not exceed in the whole £25,000. The proposal for dividend on the new capital is 7 per cent. on ordinary issues and 6 per cent. on the preference. The borrowing power on the new capital is the usual one-third. For gas a standard price of 4s. 4d. per 1000 cubic feet is suggested, with the usual sliding-scale provisions attached. The Company ask for the repeal of the section of their Order of 1894 relating to testing, and suggest that the burner to be used shall be the "Metropolitan" argand No. 2, with Harcourt's 10-candle pentane lamp as the standard. [*Parliamentary Agents: Messrs. Tahourdins and Hitchcock.*]

The East Hull Gas Company were a couple of sessions ago in Parliament; and last session they were again there defending themselves against the expropriation scheme of the Corporation. This year they have a short Provisional Order before the Board of Trade, to enable them to alter the method of testing gas in accordance with modern principles—that is to say, by employing the "Metropolitan" argand No. 2 burner and the Harcourt 10-candle pentane lamp for testing 14-candle gas. It is proposed to repeal the section of the Company's Act of 1867 referring to these matters. [*Parliamentary Agents: Messrs. Martin and Co.*]

By the Rainford Gas Order, three private persons are seeking authorization to construct and maintain works in the parish and urban district of Rainford. The share capital is put at £8000 (with dividend limited to 10 per cent.), and borrowing powers up to one-third. Lands are scheduled for works, and, by agreement, it is proposed to hold powers to acquire land up to 3 acres for other purposes. The illuminating power of gas is proposed at 14 candles; and Sugg's No. 1 "London" argand is named for testing. The maximum price of gas is suggested at 5s. 6d., with power to the Board of Trade to alter it or substitute a standard price with the sliding-scale. [*Parliamentary Agents: Messrs. Lees, Butterworth, and M'Donnell.*]

A modest Order is that promoted by the Rothwell Gaslight Company. It is really only to get additional land and works powers. Plots of land are scheduled for works and storage; and powers to buy further lands up to 2 acres for other purposes are asked. [*Parliamentary Agents: Messrs. Hamlin and Co.*]

The Tenterden and District Gas Company, Limited, are before the Board for up-to-date powers, notwithstanding that the local authority are asking "in another place" for powers of purchase. Request is made for capital to the amount of £10,200, consisting of £4200 share capital already raised, and additional capital amounting to £6000. Respecting dividend, the original capital is limited to 10 per cent., preference capital to 5 per cent., and additional capital (so it is proposed) to 7½ per cent. Borrowing power is asked to the amount of one-third of the capital. A renewal fund is suggested. The gas-works land is scheduled; and it is desired that power should be conferred for purchasing up to an additional 3 acres. A standard illuminating power of 14 candles is proposed, tested by the "Metropolitan" No. 2 burner and the Harcourt 10-candle pentane lamp. A maximum price of 5s. 6d. for gas is desired, with power of revision to the Board of Trade at the expiration of three years, with (if a standard price is then imposed) the application of the sliding-scale. [*Parliamentary Agents: Messrs. Sharpe, Parker, Pritchards, Barham, and Lawford.*]

In a Provisional Order promoted by the Burgh of Wishaw, principally in connection with their electricity undertaking, there is a clause contemplating the giving of power to the Council to supply gas by agreement to companies or authorities outside the borough. [*Parliamentary Agents: Messrs. A. & W. Beveridge.*]

Mr. F. W. Talbot is the "undertaker" promoting the Woolmer and District Gas Order. The limits of supply comprise Headley, Kingsley, and Selborne in the rural district of Alton. The authorized capital is proposed at £8000, and not more than a 10 per cent. dividend is to be paid on the money expended on, or used in, the undertaking. Borrowing powers it is intended shall be limited to £2000. Lands for works are described in the schedule of the Order; and up to 3 acres is the extent of the land purchase powers required for other purposes. The Order stands unique among the Bills and Orders of the session in asking for a standard illuminating power of 15 candles, as tested by the "Metropolitan" argand No. 2 burner. A standard price for gas of 5s. 3d. is mentioned, with sliding-scale on the ordinary terms. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

THE RESPONSIBILITY OF EXPERT WITNESSES.

BOTH in law and in fact, the position of an expert witness is a somewhat peculiar and unique one. The ordinary witness in a Court of Law has, in general, merely to speak to actual facts within his own knowledge; the Court is not concerned with his opinions or beliefs. But the very contrary is the case with the expert witness. He frequently neither knows, nor is expected to know, anything about the happenings or events concerning the matter in issue. From the very nature of the subject, he often can only speak of his judgment, belief, inferences, or deductions. He exercises a function distinct from, and above, that of an ordinary witness; and his duty is something akin to that of an assessor to the Jury, where there is one, or of technical adviser to the Judge or tribunal. Obviously, then, it is a great, important, and honourable position, involving great responsibility.

Unfortunately, this high standing has, in many callings and cases, not been realized; and, to quote from a recent edition of a standard law-book on evidence, "there can be no doubt that testimony is daily received in our Courts as 'scientific evidence' to which it is almost profanation to apply the term, as being revolting to common sense, and inconsistent with the commonest honesty on the part of those by whom it is given." It is such unscientific—to use no stronger word—evidence as that to which the above quotation refers, that has given rise to the legal quip which says (but in more terse and forciful language than we can here use) that there are three classes of witnesses: (1) Untruthful, (2) most untruthful, and (3) experts. The general result of this debased and biassed evidence is that there is a legal consensus of opinion that, in general, "the testimony of experts is usually considered to be of slight value;" and Lord Campbell once said that "hardly any weight should be given to their evidence." In particular, the class of surveyors has been singled out as the purveyors of unreliable testimony, as, for instance, by Sir John Romilly, Master of the Rolls, in *Waters v. Thorn* (1856, 22 Beav. at p. 556). It must, however, be remembered that all persons who start off with some preconceived opinion or plan, and then look for facts or arguments in support thereof, are particularly liable to errors of misconstruction, whether they be engineers or surveyors, medical men or scientists, barristers or policemen.

This being so, the true expert witness should be especially on his guard against any clouded vision, against any unwarranted fitting-in of supposed or unsifted facts; and, in short, he should bring his scientific training and mind to bear, not only upon the one-sided facts or fancies that may be presented to him, however alluringly, but also upon the statements or views of the other party. This, as we regard it, is nothing more than his duty to himself; for a scientific witness, if worthy of the name, is one who has devoted himself to the acquisition of some particular form of knowledge with the object of arriving at the truth concerning it. An untruthful scientist would therefore be a contradiction in terms, and an abnormality in nature. To know the truth and to speak the truth, in the very widest sense of the expression—that is to say, the truth as to external facts as well as to internal consciousness—we conceive, sums up the whole duty of the expert witness. His is a most arduous calling. It almost invariably implies long years of constant application and steady investigation. It necessitates gifts both of head and of heart. It requires strength of will and force of character.

Such high requirements and such lofty characteristics, we do not hesitate to affirm, are to be found among those in the gas industry—whether in the Parliamentary Committee-Rooms or in the Courts of Justice—who usually are called upon to give skilled evidence appertaining to their profession. One may quite honestly see "black," and another may equally honestly see "white;" and the real shade to the majority may be "grey." If every person saw the same thing in the same way, what a colourless and uniform world it would be! That people do not see alike is true of mere physical objects. How much more true must it be of abstract reasoning and judgment. Thus there is every room for *bonâ fide* differences, but none for mere mercenary contradictions. It is to the standing honour and credit of our gas expert witnesses that they have always been singularly free from anything savouring of sheer perverseness, and have ever endeavoured to act honestly and fearlessly in fulfilling the difficult duties of skilled advisers which they have had entrusted to them. That a high sense of their responsibility, a keen regard for uprightness, and an unswerving attitude toward truth and justice will always be the unmistakeable characteristics of them and of their successors, we fervently hope and believe.

Association of Water Engineers.—We learn from a circular issued by the Secretary (Mr. Percy Griffith, M.Inst.C.E., F.G.S.) that arrangements are being made to hold the summer meeting of the Association at Birmingham, on the 25th, 26th, and 27th of June; Mr. H. E. Stilgoe, M.Inst.C.E., the City Engineer, having been elected President for the year 1908-9. Mr. Griffith states that an interesting programme is in course of preparation, and he invites members to contribute to the technical interest of the meeting by submitting papers. Should they not be prepared with a subject, he submits a number of suggestions to assist them in making a selection. To allow of papers being circulated before the meeting, it is essential that they should be in the Secretary's hands not later than the 1st of May.

THE LABOUR CONFERENCE.

WHAT is stated to have been the largest annual conference of the Labour Party took place at Hull last week, when some 400 delegates attended, representing over a million members of Trade Union, Co-Operative, and Socialist Organizations. Some of the questions considered were, of course, of the same character as those with which one is accustomed to meet in connection with the Trades Union Congress which is held in the autumn of each year; but the outstanding features of the gathering that has just concluded were without doubt the discussions which took place upon the subject of Socialism, the outcome of which was two apparently conflicting decisions.

The President of the Conference was Mr. Walter Hudson, M.P., who, in the course of his Inaugural Address, ventured on the assertion that, with the result of two years' work of the Labour Party before the country, much of the timidity or misunderstanding of a few years ago respecting their new party in the political arena would soon have vanished. The result of the bye-election at Jarrow—when Mr. Pete Curran was returned—brought the number of labour men in the House of Commons up to 31; and the President devoted some time to dealing with what they had done. Referring to the subject of old-age pensions, he said that the Government accepted the principle, but declined to give a private member's Bill which was brought before the House facilities to pass through, as the Chancellor of the Exchequer in his Budget proposals had allocated £2,250,000 as a nucleus with which to make a beginning, he hoped, this year. Looking back upon the numerous promises they had had upon the question, they were obliged now to regard it as one of the necessary reforms very much overdue. Old-age pensions and unemployment were to be their questions of first importance as a party this year. In his concluding remarks, he urged the desirability for the creation of a Labour newspaper, so that they might "be in a position to contradict at first-hand—and that with emphasis—the charges of irreligion, the destruction of the home and family life, that every vote given for a Socialist was a vote for the House of Lords, and the numerous wilful misrepresentations which were being made, and, it was not too much to presume, would continue to be made, in order to allure the wage-earning class from the movement designed to bring them more justice and equity through the making of better laws."

It was on the second day of the meeting that the first of the discussions on Socialism took place, on a proposal to amend the constitution, by altering the "object" of the party, which had hitherto been defined as: "To organize and maintain a Parliamentary Labour Party, with its own whips and policy." For this, it was proposed should be substituted: "To organize and maintain a Parliamentary Labour Party whose ultimate object shall be the obtaining for the workers of the full results of their labour, by the overthrow of the present competitive system of Capitalism and the institution of a system of public ownership and control of all the means of life." In the early part of the discussion which took place on the motion, the Socialists made the running; but it was not long before a delegate warned the conference that, if it were passed, it would exclude from the party every organization that was not prepared to declare for Socialism, which would be deplorable, as they welcomed Trades Unionists within the alliance. Another speaker declared that "the time for this motion was not yet;" and that if it were pressed, it would tend to strain the good relations which now existed between Trades Unionists and Socialists. He advised the Socialists to wait until their organized members more nearly approximated to those of the organized Trade Unionists. Others also pointed out the danger of the proposed change—one delegate declaring that if this test had been insisted on in the first place, there would have been no Labour Party at all; and on a division, the motion was rejected by about ten to one.

During the subsequent proceedings, it was announced that negotiations had been going on satisfactorily with regard to the starting of a Labour newspaper, and that it was hoped that such a publication would, before the time arrived for the next conference, be established. The Gas Workers and General Labourers' Union and the National Union of Labour joined in a resolution, which was carried, instructing the Labour Party to introduce and support the Bill of the National Federation of Colliery Surface Workers for an eight-hours day "for all classes of workmen engaged in the manipulation of coal, direct or indirect, or in the manufacture of coke, and including all workmen engaged upon or about a colliery surface, who are or may be called upon to work seven days a week." The conference afterwards agreed unanimously to a resolution for compulsory prohibition of work between noon on Saturday and six on Monday morning, except to do repairs to machinery

It was on the third, and last, day of the meeting that the Socialists found an opportunity of avenging their previous defeat. Towards the close of the proceedings, a resolution was brought forward, on behalf of the Amalgamated Society of Engineers, in the following terms: "That, in the opinion of this conference, the time has arrived when the Labour Party should have as a definite object the socialization of the means of production, distribution, and exchange, to be controlled by a democratic State in the interest of the entire community, and the complete emancipation of Labour from the domination of Capitalism and Landlordism, with the establishment of social and economic equality between the sexes." The Standing Committee were defeated in a very reasonable attempt to get the motion deleted, on the ground that the principle it contained had already been discussed; and after the closure had been agreed to, the resolution was carried by 514,000 votes to 469,000. Though the majority in favour was thus not very large, the figures are extraordinary when compared with the division the previous day, when the motion in regard to Socialism was defeated by 951,000 votes to 91,000. Remarks made by delegates after the meeting showed a distinct desire to belittle the effect of the resolution, and to deny that the party had bound itself to Socialism; one delegate giving it as his opinion—and in this at least many other people will be inclined to agree with him—that by its action the conference had stultified itself.

Next year's gathering will take place at Portsmouth.

THE RELATION BETWEEN THE RATE OF FLOW OF THE GAS AND PURIFYING EFFECT.

IT is frequently held that the activity of oxide of iron in purifying vessels is practically independent of the rate of flow of the gas through the material. If this view is accepted, it follows that the quantity of oxide through which the gas is passed determines the efficiency of the purification, and that therefore, as the depth of material traversed is increased, the rate of flow of the gas may be increased without detriment to the efficiency of the process. The classical experiments of Herr Kunath, however, refuted this view; and Herr Lux, of Ludwigshafen-on-the-Rhine, has recently redirected attention to Kunath's work by publishing a summary of the results and conclusions to which it led. The investigations were made by passing crude coal gas through a glass cylinder charged with Lux's purifying material, which is a highly active artificial oxide of iron containing alkali, which is obtained as a bye-product in the manufacture of alumina from bauxite. The rate of flow of the gas through the cylinder of purifying material was carefully measured, and varied from time to time, and the action of the outflowing gas on lead acetate paper was observed. New and revivified purifying material were both tried.

It appeared from Kunath's experiments, that when the rate of flow of the gas was 0·055 foot per second new material removed all the sulphuretted hydrogen, as the outflowing gas caused no discoloration of the lead test paper. But at rates of flow appreciably higher than this, the outflowing gas stained the test paper a light brown, although the purifying material had not become sulphided beyond an initial layer. The subsequent layers of unacted-upon material did not avail to remove the last traces of sulphuretted hydrogen from the gas until the rate of flow was reduced to about 0·055 foot per second, whereupon they again became operative. In regard to revivified Lux's purifying material, it was found, similarly, that a rate of flow appreciably in excess of 0·016 foot per second resulted in the lead paper being stained. In order to secure a rate of flow within the latter limiting value, it is necessary to allow a cross-sectional area of purifier of 7 square feet per 10,000 cubic feet of gas passing through the purifier per diem. If existing purifiers do not admit of this allowance under full work, when the vessels are used in series, the rate of flow should, according to Herr Lux, be reduced by working two or more of the vessels in parallel.

The experiments of Kunath indicate that it is not the number of the consecutive vessels, or the depth of the material in them, which matters, but only the cross-section. When the cross-section varies owing to the vessels not being all of the same size, that of the smallest in the series should be taken as the cross-section which is material. It is obvious that the rate of flow of the gas will be highest in the vessel which has the smallest cross-section. The experiments further showed that, provided the rate of flow did not exceed 0·016 foot per second, Lux's purifying material would continue to purify the gas even after it had been revivified 37 times. The results recorded are of much interest in another direction. They may to some extent explain the observation made in many English gas-works to the effect that oxide of iron is not so satisfactory as lime or Weldon mud for removing the last traces of sulphuretted hydrogen. Probably the rate of flow of the gas through the oxide purifiers in those works has been in excess of the limiting rate found by Kunath.

According to "Progressive Age" (New York), Coroner Harburger of New York City has prepared a Bill to be introduced in the New York Legislature that provides that stop-cocks on gas-fixtures shall be not less than a foot apart when there are two on a pipe. In turning off gas used for one purpose, one is liable unconsciously to turn it on through another vent, especially where the stop-cocks become loose in turning from constant use. The Coroner has found that many asphyxiations result from this cause. What won't we have laws upon, says our contemporary, if this keeps up? If inspection by trained experts were required, under such regulation as might be developed by the Public Service Commission, for example, some good might follow; but this interference in the operation of industries by amateurs who imagine they have dscovered a cure for some fancied evil, and succeed in having the notion dignified as a law, is nothing short of disgusting. Truly practical intelligence must lurk somewhere in legislative halls, even though it seldom shows itself.

ABILITY COMPETITIONS AT TOTTENHAM.

A Promising Scheme.

THE Chairman and Directors of the Tottenham and Edmonton Gas Company, who are always anxious to do everything they can to promote good feeling among their staff and workmen, and also to give them an interest in their work, have lately started a series of "Ability Competitions" which should materially assist in both these directions.

The system can best be explained by reference to the notice on the subject (signed by the Engineer, Mr. A. E. Broadberry) which was issued to the staff and workmen. This states that "in order to encourage the study of details by all members of the staff and workmen, and to give everyone, from the bottom upward, an opportunity of showing what knowledge and ability he possesses, the Directors have decided to give a prize of half-a-guinea for the best paper prepared on subjects which will be set from time to time, and at the end of the year a prize of two guineas for the best aggregate number of marks. In judging the papers, regard will not only be had to the correctness of the arguments, but also to the clearness of expression, neatness, and spelling."

The first subject selected for the purpose was the "Principles Involved in Atmospheric Burners, and the Effects of Under and Over Aeration," replies to which had to be sent in by Friday, the 17th inst. Nineteen papers were sent in, and the competitors represented practically every branch of the business—foremen, fitters, slot-collectors, lads in the office, clerks, apprentices, and junior assistants all being among the number. The first prize was awarded to Mr. P. C. Gardiner, of the Chemical Laboratory, a copy of whose paper appears below.

The paper for next month will be the "Chief Causes of Complaint by Gas Consumers, and what Steps should be Taken to Rectify them." This question was suggested by Mr. H. Banyard, General Foreman, in response to an invitation contained in the notice already referred to.

PRINCIPLES INVOLVED IN ATMOSPHERIC BURNERS, AND THE EFFECTS OF UNDER AND OVER AERATION.

The great German physicist Bunsen was the first man to succeed in turning the idea of burning a mixture of coal gas and air to practical utility. Indeed, he obtained not only a smokeless flame, which was his object, but also a much hotter one than had previously been in ordinary use. For the purpose of discussing the bunsen burner, coal gas may be regarded as a mixture of gaseous substances which are essentially composed of carbon and hydrogen. The phenomenon we know as "burning," is really the rapid oxidation of the carbon and hydrogen in the gas to carbon dioxide and water vapour by the oxygen of the atmosphere.

In the case of burners in which no air is allowed to mix with the gas before it arrives at the point of ignition, it is impossible for all the constituents of the gas to get oxidized during the brief time they are in the heated zone of flame, as the only oxygen available is on the outside of the flame. Consequently, some of the less easily oxidizable carbon floats upward through the flame in the free state; and it is these particles of carbon heated to incandescence that give the flame its luminosity, while they also account for its smokiness. Going a step further, we see that if air be allowed to mix with the gas before reaching the flame, there is much greater likelihood of complete oxidation of the constituents of the gas being effected; and, of course, with complete combustion, a greater amount of heat will be generated than when only part of the carbon is burnt up. Again, if all the carbon is burned to carbon dioxide, which is a gas, the cause of the luminosity is removed, and a non-luminous flame is the unavoidable result.

The bunsen is therefore constructed with an air-inlet to the gas-tube some 4 or 5 inches from the flame-end; and at the same point the gas-way is restricted by the nipple, the object of which is to give the gas increased velocity just as it passes the air-inlet, thus causing the gas to draw in a considerable quantity of air. Having to travel the 4 or 5 inches to the burner-head gives the gas and air an opportunity of getting mixed. The thorough mixing of the gas and air is of such great importance in the application of this burner to incandescent gas lighting, that almost every new incandescent burner placed upon the market has some special arrangements to this end. The most striking instance is the Kern burner, in which the straight flow of the gas and air is obstructed by perforated conical screens to assist the mixing. One of the latest ideas is the introduction of a thermo-pile, which is heated by the products of combustion; and the electricity produced is utilized to work a small motor, which, in turn, drives an agitator in the mixing-chamber.

The heating effect of a bunsen flame is governed by the proportions of gas and air which are burnt to produce it; and generally it may be stated that the greate rthe proportion of the air the greater is the heat obtained. Not only does the heat of a flame alter with the variation of the air supply, but its structure and appearance change considerably. At first, by excluding all the air, a long luminous, smoky flame is obtained. Then, by admitting a small quantity and gradually increasing the proportion of air, the following changes will be noticed: (1) Flame becomes gradually non-luminous; (2) flame becomes gradually shorter; (3) blue inner cone appears; (4) both cone and outer zone become shorter; (5) greenish tinge appears in inner cone. All this time the flame has been getting hotter; and it has now—at (5)—arrived at the condition in which it is of greatest use in the incandescent burner. If the process of admitting more and more air be continued, the flame grows still shorter, becomes uneven, "roars," and finally lights-back.

When properly adjusted, the bunsen is a very good heating agent; but in itself it is of no use for lighting purposes. By applying it to the heating of an incandescent mantle, however—which consists of a "stocking" impregnated with a mixture of the oxides of thorium and cerium—a very bright light is obtained, and the better the flame the better the light given by the mantle.

From the previous remarks, we see that, with an insufficient supply of air, the bunsen flame is long, and will therefore probably burn beyond the mantle, in which case the flame will be unable to give all its heat to the latter, which will consequently appear dull. Further, if insufficient air is used to completely burn up all the constituents of the gas, particles of free carbon appear as soot above the burner, and perhaps on the mantle itself. This does not, however, permanently injure the mantle, as the carbon will be burnt off as soon as sufficient air is admitted to the burner.

In cases of over-aeration, there is a possibility of the burner lighting-back, under which circumstances the mantle gives very little light, and the burner generates a foul smelling mixture of gases, chiefly consisting of acetylene, which is both poisonous and explosive. Even if the excess of air is not sufficient to make the burner light-back, it will "roar" and give an unsteady light. Generally, therefore, the greater the proportion of air burnt with the gas to give a steady flame, the better the light obtained from the mantle. By causing the gas to rush through the nipple at a greater pace, a larger proportion of air can be drawn into the burner; and the result is that a brighter light is obtained from a unit quantity of gas. In order to effect this, artificial means of boosting up the pressure of the gas are resorted to; and this is the basis of all high-pressure lighting systems, which give a superior and more economical light as compared with the ordinary system.

Reports of Gas Associations for 1907.—It will be seen, from an announcement appearing elsewhere, that the above-named work is now ready. The volume contains the collected reports which were given in the "JOURNAL" of the proceedings at the meetings of the various District Gas Associations last year. The technical matter occupies nearly 600 pages; and it is illustrated by 75 diagrams, &c., and a folding plate. Reference to any subject is facilitated by an index; and at the end of the book are given lists of the officers and members of the Associations. The volume is the twenty-fifth of the series. It forms a useful companion to the "Transactions of the Institution of Gas Engineers."

Storage of Coal Under Water.—This subject has been at times referred to in the "JOURNAL" in connection with experiments carried out in England. In the "Chemiker Zeitung" for the past month, Dr. Hart describes a test he made to ascertain the effect upon coal of sub-aqueous storage. According to the "Chemical Trade Journal," quantities of 2 kilos. of English steam coal were placed in bottles, together with a litre of distilled water, and the coal and water were examined after intervals of four and eight weeks. The coal was found to be practically unchanged, except that it had taken up a very small quantity of water, which could not be drained off, but could be eliminated by drying. Practically nothing had gone into solution in the water except traces of sulphates and chlorides of magnesia and lime. This confirms the reports of satisfactory storage results which have appeared in England.

Analyses of Accounts of Gas Undertakings.—We have received the "Gas World" analyses of the accounts of gas undertakings for the year 1906-7. They are contained, as before, on four large sheets (linen-backed for strength), bound in a stiff cloth cover, and relate to 120 company and municipal undertakings—being six more than in the analyses for the preceding year. The new entries are the Burslem, Leeds, Mossley, and Paisley Corporations, and the Otley and Stretford Gas Companies. Mossley is a restoration, as the accounts of the Corporation were dealt with in the analyses for 1904-5. This publication is fairly well known; but the edition under notice embodies several important changes to which attention may be directed. On the left-hand sheet, in conjunction with the quantity of coal carbonized, the percentage of carburetted water gas made is now given; and the unaccounted-for gas in percentage of make and per mile of main, replaces the figures of the gas accounted for. The receipts from stoves and fittings are separated from the gas and meter rentals. The omission of the figures for public lighting and the illuminating power of the gas, and other alterations in the arrangement of the figures on this sheet, allow of the manufacturing charges and the rates and taxes being brought in, which is an improvement. On the opposite leaf will be found particulars in regard to the charges for distribution and management, the bad debts, the net cost of gas, the mileage of mains, the number of consumers and public lamps, the capital per ton of coal and per 1000 cubic feet of gas sold, and the reserve funds. On opening the sheets, the eye is confronted by a mass of figures; but as in previous analyses, assistance is afforded in tracing those relating to each undertaking by the use of faint blue lines dividing the whole of the names into groups of three, as well as by the repetition, on the inner margins of the sheets, of the figures showing the numerical order.

ILLUMINATING TRUTHS.

(7)

THE OSRAM LAMP—FICTION AND FACT.*

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UP and down the country the advertisements of the manufacturers of the Osram electric lamp—the General Electric Company—have been appearing in the newspapers. In those advertisements statements have been made as to the relative performances of Osram lamps and incandescent gas-burners, which it is submitted with deliberation are absolutely false. There have been opportunities given to the General Electric Company to substantiate those statements; but their silence may be taken as a refusal to attempt to verify or to withdraw the published assertions, which they must know full well to be totally untrue. And those misstatements, or imitations of them, have been adopted by many managers of electricity supply undertakings.

The Welsbach Incandescent Gas-Light Company, Limited, have on several occasions challenged the General Electric Company to a competition for the purpose of either justifying, or proving the baselessness of, their declarations; and the day has yet to come when the latter Company will be inclined to take up the challenge. The offer of the Welsbach Company is a very fair one. It is that they will instal a house throughout with the Kern incandescent gas-burner; the General Electric Company on their part to instal a precisely similar house with their Osram light; the candle power and consumption of both means of lighting to be tested at intervals during a year by two independent experts—one gas and one electrical. If the competition does not prove at the end of the year that light for light the Welsbach system, allowing for renewals at current prices in both instances, comes out at less than half the cost of the electrical installation, the Welsbach Company will pay for the electrical installation, and subscribe £25 to any charity the General Electric Company may nominate. If the contrary, the General Electric Company to pay for the incandescent gas lighting installation, and subscribe a like amount of money to a charity. The terms are clear and fair. The challenge has not been taken up; and the fact is eloquent of an appreciation on the part of the General Electric Company of their inability to substantiate the statements in their advertisements. To give the General Electric Company every inducement, the Welsbach Company have increased their offer to £100 to be paid over to a charitable institution. Still the challenge is not taken up.

If consumers are instructed in the way of making calculations for themselves, and have a basis from which to proceed, it will be easy for them to test the veracity of the statements to which allusion has been made. One of the objects of this leaflet is to give consumers a starting base by example. In the first place, there are a few considerations affecting the

Reputed and Actual Candle Powers of the Osram Lamp.

The nominal candle power advertised for the Osram lamp is not what the consumer may expect to realize in practice. In the first place, the advertised nominal candle powers of the lamps—the 32 and the 50 candles—are stated in what are known among lighting experts as the German Hefner unit, not the British standard candle, of which an explanation was given in No. 4 leaflet. Roughly speaking, 11 Hefner candles are equal to 10 British standard candles; so that the consumer has to make a deduction in this respect from the reputed candle powers of these lamps. Supposing, for example, at one point of lighting, a consumer has two (so called) 50-candle power Osram lamps, equalling together according to assertion, 100 candles, that 100 should be described as Hefner units, and, rendered in British standard candles, the nominal illumination should be described at about 90 candles—or 10 per cent. less than the advertised. But do these lamps really give even this candle power? The writer is aware that, as a rule, they do not, apart from the illumination differences caused by the variations of the electricity supply voltages or pressures. But his own testimony may be taken as prejudiced; and therefore quotation may be made from electricians.

At the meeting of the Incorporated Municipal Electrical Association in 1907, Mr. R. M'Court, of Harrogate, stated that six dozen Osram lamps had been tested at Harrogate; and the actual illumination of the 32-candle type varied from 17 to 36 candles (the number of watts used per hour being from 29 to 36) and the 50-candle power lamps varied from 27 to 44 candles (the number of watts used per hour being from 36 to 48). These tests were made under favourable conditions; and not under the ordinary running conditions found in the house or shop of the general consumer. The figures under these conditions show a big variation, and indicate that the lamps do not come up to the illuminating powers asserted by canvassers and the makers of the lamps. Mr. Lancelot Wild, of the Westminster Electrical Laboratory, gives the illuminating power of "32-candle" Osram lamps at from 26 to 29 candles; and the consumption of electricity from 34 to 36 watts per hour each, or from 1·2 to nearly 1·4 watts per candle. Further confirmation of variation from reputed and actual candle powers is given in a paper by Messrs. Morris, Stroude, and Milward Ellis, published in the "Electrician" during July-August, 1907. Their tests gave for 32-candle Osram lamps 25·9 and 29·1 candle power and for 50-candle Osram lamps 46, 43·9, and 49 candles. These figures again show variability between actual and nominal candle powers. The hourly consumption of electricity was from 1·23 to 1·37 watts per candle power. Regarding the point as to the effect of variable voltages on the illuminating power of electric incandescent lamps, that effect is not quite so great upon metallic filament lamps—those of the class of the Osram—as upon those of the carbon filament type; but still the effect is an appreciable one. It may be taken from tests made on this point that a variation of 1 per cent. in voltage produces about a 4 per cent. change in the candle power of such lamps, as compared with the 6 per cent. change produced with carbon filament lamps. And no electrical engineer can truthfully talk to the consumer about the constancy of his voltages. However, from the figures given here consumers can easily calculate what their consumption of electricity is likely to be (*plus* installation and renewal charges).

Costs of Osram Lamps v. Incandescent Gas-Burners.

Let us take, as an example, first the middle of the figures of Messrs. Morris, Stroude, and Ellis for the so-called 50-candle power Osram lamps. Supposing a consumer has twenty of these 50-candle lamps fixed, each giving 46-candle power on a consumption of 1·27 watts per candle power per hour (1000 watts representing a unit of electricity). 46 × 1·27 = 58·42 watts per lamp per hour. Therefore, the twenty lamps would use per hour: 58·42 watts × 20 = 1168·4 watts, or not far short of 1¼ watts an hour. This at 6d. per unit would represent (say) 7½d. an hour; at 5d. a unit (say) 6d. per hour; at 4½d. per unit (say) 5½d. per hour; at 4d. per unit, 5d. per hour; at 3½d. (say) 4½d. per hour. The little differences will allow for variation of lamps in consumption. Now supposing again a shop or dwelling-house uses the twenty lamps for 1500 hours in a year. We have seen that the 20 lamps will consume 1168·4 watts per hour; so that 1168·4 watts × 1500 hours ÷ by 1000 watts = (say) 1752 units.

Cost of Electricity for Twenty Nominal 50-Candle Power Osram Lamps for 1500 Hours a Year.

1752 units of electricity at—

6d. per unit	£43	16	0
5d. ,,	36	10	0
4½d. ,,	32	17	0
4d. ,,	29	4	0
3½d. ,,	25	11	0
3d. ,,	21	18	0

WITHOUT ALLOWING ANYTHING FOR INSTALLATION AND FIRST COST AND RENEWAL EXPENSES.

The twenty 46-candle power Osram lamps would give a total illuminating power of **920** candles when everything is in order.

Twenty 64-candle power incandescent gas-lamps would give a total illuminating power of **1280** candles, or about one-third more, and at a considerably less expense.

With quite the common form of incandescent gas-burners, 64-candle power can be obtained for a consumption of 3½ cubic feet of gas an hour. 20 burners × 3½ cubic feet = 70 cubic feet an hour. 70 feet × by 1500 hours in a year = 105,000 cubic feet.

Cost of Gas for Twenty 64-Candle Power (3½ Cubic Feet) Ordinary Incandescent Burners for 1500 Hours.

105,000 cubic feet of gas at—

4s. 0d. per 1000 cubic feet	£21	0	0
3s. 6d. ,, ,, ,,	18	7	6
3s. 0d. ,, ,, ,,	15	15	0
2s. 6d. ,, ,, ,,	13	2	6
2s. 0d. ,, ,, ,,	10	10	0

Now from these figures, it will be seen, on the electricians' own showing of illuminating powers and electricity consumption for the nominal 50-candle power Osram lamp, that a greater illuminating power, for less outlay than half the expenditure on electricity alone (without counting cost of installation and renewals), can be obtained by common forms of incandescent gas-burners—not the superior types or economical inverted ones.

Let us take now the 32-candle power Osram lamp, and treat it in the same way as we have done the nominal 50-candle power lamp. The best figures given by Messrs. Morris, Stroude, and Ellis for a 32-candle power lamp shall be adopted—that is to say, 29·1 candles at 1·32 watts per candle power per hour. Assume, again, a shop or dwelling-house requiring twenty of these lamps (or ten pairs). 29·1 candles × 20 = **582** candles, which is not so much as the illuminating power to be obtained by ten incandescent burners each giving 64 candles. 64 × 10 = **640** candles.

29·1 candles × 1·32 watts per candle = 38·41 watts per lamp per hour. 38·41 watts × 20 lamps = 768·2 watts per hour × 1500 hours a year = a consumption of 1152 units of electricity.

Cost of Electricity for Twenty (so-called) 32-Candle Osram Lamps for 1500 Hours a Year.

1152 units of electricity at—

6d. per unit	£28	16	0
5d. ,,	24	0	0
4½d. ,,	21	12	0
4d. ,,	19	4	0
3½d. ,,	16	16	0
3d. ,,	14	8	0

* This article will be reprinted as a leaflet for distribution, forming the seventh of our series of "Illuminating Truths" leaflets.

WITHOUT ALLOWING ANYTHING FOR INSTALLATION AND FIRST COST AND RENEWAL EXPENSES.

Ten incandescent gas-burners, each giving 64-candle power, would use 3½ cubic feet each × 10 = 35 cubic feet an hour, × 1500 hours a year = 52,500 cubic feet.

Cost of Gas for the Ten 64-Candle Power Incandescent Gas-Burners in 1500 Hours.

52,500 cubic feet at—

4s. 0d.	per 1000 cubic feet	£10	10 0
3s. 6d.	,, ,, ,, ...	9	3 9
3s. 0d.	,, ,, ,, ...	7	17 6
2s. 6d.	,, ,, ,, ...	6	11 3
2s. 0d.	,, ,, ,, ...	5	5 0

Again we see that for a greater illuminating power, the gas consumed in ordinary incandescent burners (not the superior vertical or the inverted ones) would only cost (according to price) from less than one-third to less than one-half the cost of the electricity used by nominal 32-candle power Osram lamps. With bijou inverted lights, a more favourable result could be shown for gas.

Increased Cost from the Osram Lamp.

It is, however, a question as to whether in many cases, while illumination will be greatly increased, the cost of electricity will not also be increased unless a transformer (involving further expense and possibly troubles) be employed. Take a case where single 16-candle carbon filament lamps have been employed; and it is determined, instead of installing a transformer, to put in at each point (the necessity for which will be explained presently) clusters of two or more nominal 32-candle Osram lamps, each using (say) close upon 40 watts of electricity per hour (38·41 watts was the consumption of the lamp previously referred to). Supposing only two of these lamps are fixed where only one lamp existed before, the consumption will be about 80 watts per point, in place of 64 watts under the old condition; and that is what will happen in many places, as has already happened, and is causing discontent. There is a 20 per cent. increase in consumption and consequently of cost here; and though the user gets a larger illumination, he will hardly want to supplement his old electricity account when he can get greatly increased illumination for less expense by means of the modern forms of incandescent gas-burners.

Mr. H. Faraday Proctor, the Electrical Engineer of Bristol, reported to his Committee in 1907 that tests made at the Temple Back Works with Osram lamps showed that, taking the then current prices charged for electricity in Bristol, an Osram lamp, giving 32-candle power, costs only about 15 per cent. less per hour than an average 16-candle power carbon filament lamp, including lamp renewals in both cases. But this does not take into account the necessity for running these lamps in series in most cases, or the cost, upkeep, and losses associated with a transformer.

An Instance of no Saving in Consumption—Installation Costs.

The writer has had under observation ten pairs of Osram lamps, which have taken the place of ten clusters of three carbon filament lamps, in a shop where some of the lamps are almost continuously in use during the day. Fortnightly readings of the meter during the winter months 1907-8 do not show a variation of ten units of electricity per fortnight below or above the corresponding figures for the same periods of 1906-7 when carbon filament lamps were entirely in use—that is to say, in some fortnights there have been two or three units below the corresponding fortnight's consumption, and in other fortnights a few units above. The similarity in consumption is remarkable. The suggestion of the representatives of the Electricity Supply Company that there would be, in this instance, a saving on the consumption and cost of electricity of at least one-third has not worked out in practice—the quarterly accounts totalling to almost precisely what they did before the change. The cost of conversion (without any charge for labour) from the ten clusters of three old carbon filament lamps to the ten pairs of Osram lamps was £5 5s.—made up of ten pairs of Osram lamps at 4s. per lamp (8s. per pair), £4; and ten adaptors at 2s. 6d., £1 5s.; and upon this, and the running cost, will be the expense of renewals.

Renewals.

We have shown the cost of electricity for the Osram lamps; the approximate cost of installation where a place is already wired; and now there is the cost of renewals. It is said these lamps (running in the laboratory) have an efficient life of about 1000 hours. No such period of use can be relied upon. In the first two months, one lamp in the foregoing installation required skilled attention, and two were blackened to such an appreciable extent that the illuminating power was diminished. Supposing, however, these lamps did last an average of 1000 hours, 1500 hours would mean an average of 1½ lamps per lamp installed per annum, or 3 lamps at each point of lighting. Multiply the number of lamps in use by 1½, the cost per lamp is known, and the expense of renewals is approximately found, though on this something should be added for labour for maintenance and for lamp casualties at shorter intervals than the 1000 hours.

Transformers.

The use of transformers has frequently been mentioned in this leaflet. The common voltage of electricity supply in this country is from 200 to 240; while the Osram and such-like lamps (through physical difficulties) can only be made to run on much lower voltages. Attempts to get them to do so have not outside the laboratory yet been successful. Consequently they can only be used in (what is known as) series—that is to say, in pairs or groups at each point of lighting, unless, on alternating current systems, a transformer is employed. Transformers cost money; so that the electricity suppliers cannot afford to furnish them for nothing, more especially as one result of the use of the transformer is to reduce the income from electricity. The suppliers must therefore charge a rent for them to include capital charges and maintenance. For an ordinary installation, it is possible the rent would have to be 10s. a year. But that is not all. The transformer introduces another complication into an already complicated system of obtaining light; and it is also the seat of electrical losses. The pressure to which there should be transformation would have to depend, too, on the wiring already installed. Electricity under the simplest system of supply demands a great deal of faith from the user. The transformer is another tax upon his faith. Moreover, transformation will render the electric current useless for certain other purposes, unless there be separate circuits.

A Weakness of the Osram Lamp.

A weakness of the Osram lamp (which as has been stated can only be used on low voltages without going to the expense of using transformers, or employing the lamps in series) is that it has to be used with the filament in the vertical plane. This was a matter to which Mr. Leon Gaster, an Electrical Engineer, called attention at the meeting of the British Association at the Leicester meeting in 1907. The reason that these Osram lamps cannot be fixed at an angle as in the case of the carbon filament lamp or the bijou inverted gas-burner is that the diameter of the filament is only about 0·04 mm., which is finer than the average human hair; and as the filament at the high temperature to which it is heated when running is quite soft, if the lamp is not hung perfectly vertical the filament will sag against its supports. On the other hand, the filament when cold is brittle, and should not be jarred. Messrs. Morris, Stroude, and Ellis, in the paper published in the "Electrician," to which reference has already been made, state that, from considerable experience gained in the handling and use of such lamps as those of the Osram class, it would, in their opinion, be better to make some sacrifice in efficiency in order to gain in mechanical strength. This has already been done in the case of the Tantalum lamp; but the gain of mechanical strength means a decrease of illuminating power for a given consumption of electricity.

The ease with which the filaments break is attested in a letter (published in the "Electrical Review" on Dec. 6, 1907) by Mr. Charles E. Gray, the Engineer of the Ross Electricity Works. He says that a few weeks previous to that date, he had occasion to send a sample order for 32 Osram lamps. "On receipt of these, though they had been most carefully packed, no fewer than eleven were found defective. . . . I understand," he adds, "that the manufacturers of these lamps only allow 3 per cent. for broken lamps—our lot amounts to close on 35 per cent."

In another letter in the same publication, a "Station Engineer," referring to the Osram and Tantalum lamps, remarks that the profit (if any) of station engineers and contractors is "swallowed up in paying for lamps supposed to have been sound when despatched by the manufacturers; also in replacing lamps which go absolutely black after a few hours' use."

Extinctions and Pairing.

We know that electricity supply is subjected to many troubles that cause extinctions—troubles arising in the system right away from the generating station to the filaments of the electric incandescent lamps and to the carbons of arc lamps. We need not specify these troubles here. They—or rather their effects—are well known to users of electricity. But we have seen where a transformer is not introduced to reduce voltage to the point necessary for these Osram or other metallic filament lamps, that the lamps have to be run in series. One result of this is that, in the event of the failure of one, a number of the lamps will be affected by the running in series. The "Electrician" has pointed out another difficulty. It is that lamps running in series on any one circuit must be practically identical, in order to give satisfactory results. Adds that technical authority: "At the present stage of manufacture, it is quite possible that this difficulty cannot be very satisfactorily met without careful selection. A certain amount of trouble has been caused on private lighting circuits by lamps differing to some extent, so that both lamps of a pair do not burn at the same efficiency."

In the "Installation Notes" in the "Electrical Times," on Jan. 2, this same subject is referred to. It is remarked: "To get lamps of any make to run well in series is always difficult, and metallic filament lamps are particularly unsuited for series burning. Makers of these lamps grade their filaments with great care; but the average user cannot see why it is so essential always to run pairs of Osram lamps, for instance, bearing the same series number. If one should burn out or be broken, he is apt to replace it with any spare lamp of the right voltage, without ascertaining whether it is of the correct grade; and this is fatal to their chances of a reasonable life."

Straining the Eyesight.

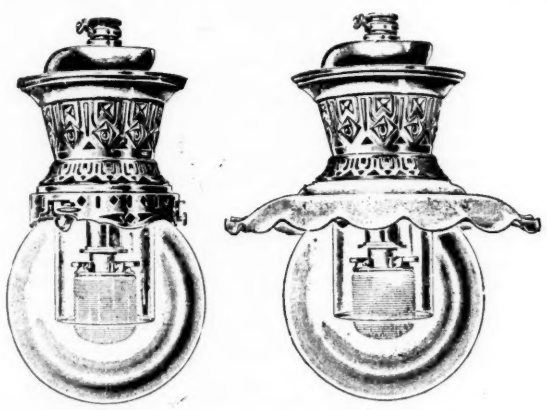
Mr. Leon Gaster (who is an electrical expert), in a paper read before the Association of Engineers in Charge on Dec. 11, 1907,

observed on this subject: "The new light sources are excessively intense or bright. Take the incandescent electric lamp for example. If you look at such a lamp when it is burning, the image of the filament on the retina is so intensely brilliant that, if you cover your eyes with the hand, you will continue to see the bright form of the filament floating in a dark field for some time. This shows that the excessive brilliancy of the image strained that part of the retina upon which it fell, so that it required some time to recover. *If the strain were continued long enough, the injury would become permanent. There are cases on record where total loss of sight has resulted from such a strain.* It may be put down as an established fact in artificial lighting that all modern light sources are too bright to be used uncovered."

With the facts presented in this leaflet—facts based upon the publications of electricians—readers may judge for themselves how far the statement sedulously circulated by electrical people is true, that the Osram lamp is more economical, or can give illumination at a cheaper rate, than the incandescent gas-burner.

CHEAP AND EFFICIENT FITTINGS.

THE "Luisin" is a form of inverted gas-lamp, with other excellencies than that of low price. It is efficient, and its design embraces several conveniences. To the new lamp attention has been called by Messrs. J. & W. B. Smith, of Farringdon Road. At the top of the lamp is a shield taking the form of an inverted shell, destined, as it efficiently does, to direct the products of combustion well away from the primary air inlets. The sleeve by which the regulation of the air supply is effected is perforated for the admission of the air in such a manner that dust and other matter that would tend to accumulate and affect the light-giving powers of the lamp are excluded. But no doubt an occasional brushing will be required to keep the perforations free. The regulator is provided with a projection so that it can be moved while the lamp is in use. There is also a special gas-regulator—in fact, inverted lamps that have no such provision are generally considered to be of little account in these days. Above the



gas-injector again is a gauze protector; so that any foreign matter carried by the gas, or dropped in in fitting, is arrested, and prevented entering the pin-hole of the injector. Between the metal bunsen tube and the fire-clay nozzle (which carries the ordinary mantle) is another piece of gauze, to obviate firing-back. There is, therefore, plenty of protection about this burner, all directed to the maintenance of efficiency. The ornamental brass casing at the top of the lamp is also removable; and the lower fittings of the lamp are arranged so that cleaning does not involve any difficult or considerable labour. Like the Graetzin lamp, this one has an interior glass surrounding the mantle. But in this case, the glass is provided with a shoulder which is the means of support upon a metal ring, and which ring connects by a bayonet joint to the body of the lamp. As the same ring carries the outer globe, both globes can be removed at the same time; and this is a great convenience. As the illustrations show, the lamps can be had plain or fitted with an opal shade. Though a low-priced lamp, it will give satisfaction on the point of illuminating efficiency.

Most of the wholesale houses are now supplying a new adjustable pendant, which offers the means (in cheap form) of raising and lowering the position of the light. Mr. Robert Hunt, Messrs. D. Hulett and Co., Limited, and Messrs. J. & W. B. Smith are among the firms showing this pendant. It is constructed of single rods, with swivels made from solid rods; and the finishes are steel bronze, polished, or antique copper. The rod attached to the bottom of the top vertical pipe is furnished with (on the end opposite to the depending tube carrying the burner) a counterbalance weight. There are various forms of the pendant—one, for example, is fitted with an oval-shaped end-piece to carry either an inverted or upright burner; another form is intended for an inverted burner only. The positions in which a cheap moveable pendant will be found a convenience are many.

AMERICAN COMMERCIAL GAS ASSOCIATION.

It may be remembered that rather more than two years ago an Association was formed in America, under the title of the National Commercial Gas Association, with the view of advancing the interests of the gas industry in that country. The objects of the Association, as set forth in a circular issued at the time, were—

1.—The promotion of increased sales of gas, the promulgation of ways and means and methods necessary thereto, and the encouragement of manufacturers to produce high-grade and highly efficient devices that require gas for light, heat, and power.

2.—The establishment and maintenance of a spirit of fraternity between the members of the Association, by friendly exchange of information and ideas on the before-mentioned subject-matters, and by social intercourse.

3.—The inducement and extension of more cordial and friendly relations between consumers and producers of gas, based upon mutuality of interest.

4.—A substantial recognition of the value of the gas appliance manufacturer to gas interests, and his importance to the commercial end of the gas industry, as well as the encouragement of fraternal intercourse between the sales division of the gas industry and the appliance manufacturers, also between the commercial interests of the gas companies and merchants who make one of their special features the sale of devices for producing light, heat, and power, wherein gas is the element required.

All officers or employees of gas companies, as well as anyone qualified to assist in promoting the objects of the Association, were eligible for membership. The first President was Mr. W. J. Clark, the Superintendent of the Fuel and Appliance Department of the Consolidated Gas Company of New York; and the Secretary, Mr. Lucius S. Bigelow, of New York. The first meeting was held in the Cadillac Hotel, New York, early in 1906, and was noticed in the "JOURNAL" at the time. The second meeting, at which about 150 members were present, was opened in the same place on the 8th inst., and the proceedings extended over three days. The following particulars in regard to them are taken from the "American Gaslight Journal."

The President of the Association (Mr. Clark) was unfortunately prevented by illness from occupying the chair; but his place was taken by Mr. Frank W. Frueauff, the First Vice-President, who delivered the address which Mr. Clark had prepared for the occasion. The papers and addresses were of an interesting character. Mr. C. A. Learned, of Meriden (Conn.), showed his colleagues "Why a Commercial Gas Association is Beneficial to the Gas Industry;" and Dr. A. C. Humphreys, the President of the American Gas Institute, and also of the Stevens Institute of Technology, delivered an address on "The Commercial Side." Mr. H. R. Kenyon gave a lecture on "The Salesman's Personnel," in which he set at a rather high standard the qualifications required for the employee referred to. Included in the list of papers were the following: "Gas Illumination in Shop Practice," by Mr. T. J. Litle; "Conducting Gas Company Employees' Meetings," by Mr. E. N. Wrightington, the Secretary of the Boston Consolidated Gas Company; "The Use of Mechanical Devices in the Accounting Department of a Gas Company," by Mr. F. H. Barnitz, of the Consolidated Gas Company of New York; and "How to Promote the Sale of Industrial Gas Appliances," by Mr. W. H. Allen, of Newark (N.J.). Some of these communications we hope to notice in subsequent issues.

The general business of the meeting included the election of office-bearers, which resulted as follows:—

President.—Mr. F. W. Frueauff, of New York.
First Vice-President.—Mr. J. D. Shattuck, of Chester (Pa.).
Second Vice-President.—Mr. D. T. Cortis, of Boston (Mass.).
Third Vice-President.—Mr. R. M. Searle, of Rochester (N.Y.).
Secretary and Treasurer.—Mr. L. S. Bigelow, of New York.

There was a good gathering at the annual dinner of the Association, which was held on the afternoon of the second day of the meeting; and some excellent speeches were made. Mr. H. L. Doherty, who was introduced as the "most successful commercial man of the day," had something pointed to say; and a noteworthy feature of his remarks was the declaration that "all the money spent in the commercial department of a gas undertaking was well laid out, even if no more business resulted therefrom, provided the goodwill of the community was obtained and retained. Another speech that was listened to with attention was that by Mr. Shattuck, who described the method used to promote the right *esprit de corps* in the staff. In a short but effective speech, the Secretary made an earnest appeal for co-operation, inasmuch as this was, he said, the only road to success.

The whole proceedings were brought to a close shortly after noon on the 10th inst.

Mr. F. H. Orme, Joint Managing-Director of Meters Limited, and a Director of the National Gas-Engine Company, Limited, whose death was announced in the "JOURNAL" for the 3rd ult., left a fortune amounting to £47,077. Alderman Daniel Stephens, of Kidwelly, who was a well-known manufacturer of silica fire-bricks, left £26,695.

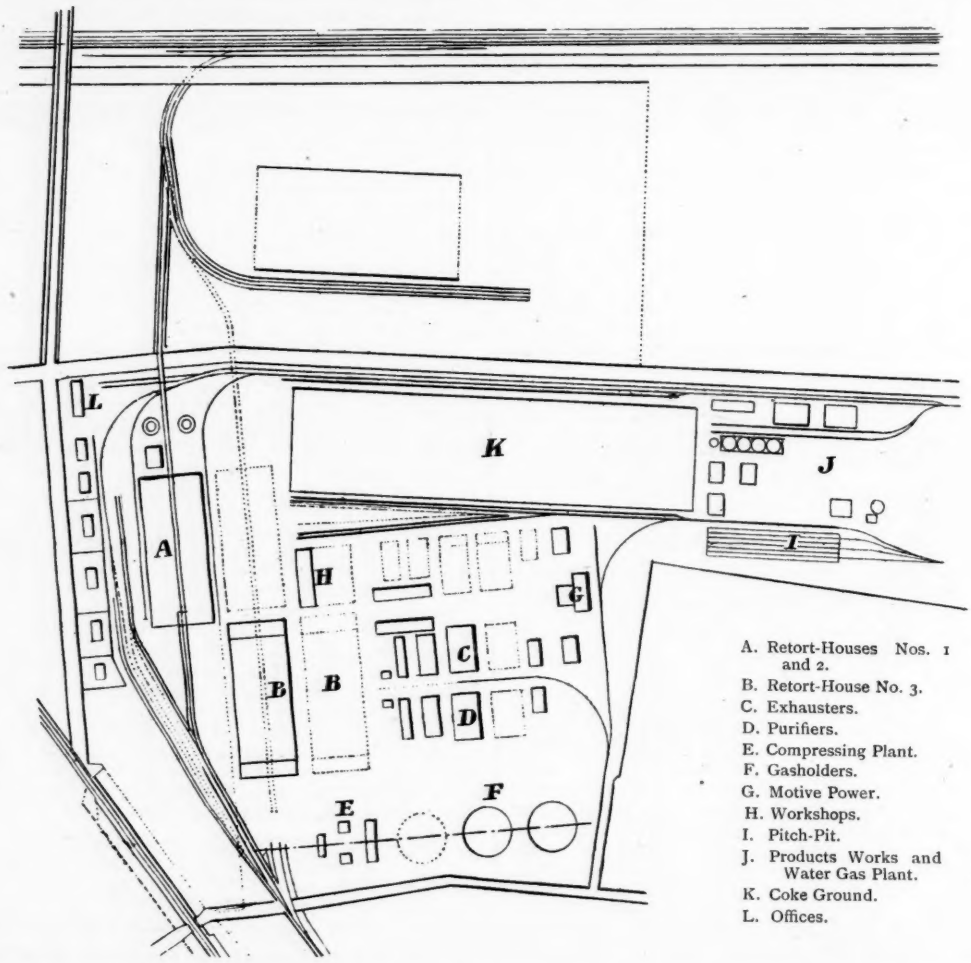
GAS SUPPLY IN THE SUBURBS OF PARIS.

The Gas-Works at Gennevilliers.

In previous issues of the "JOURNAL," particulars have been given of the manufacturing plant at the gas-works which have been erected at Gennevilliers, by the Compagnie d'Eclairage, Chauffage, et Force Motrice, for the supply of the suburbs of Paris, as well as of the distributing system by which the gas is conveyed to the various communes. We are now in a position to give a plan of the works, which has been reproduced by our contemporary the "Journal des Usines à Gaz" from a descriptive article in a recent number of the "Génie Civil," and supplement by a few additional details the particulars which have already appeared in our columns.

It will be seen from the plan that the works are in close proximity to the River Seine and to a line of railway; and they occupy an area of about 110 acres. The buildings are all of iron or armoured cement, ornamented with white bricks, and have tiled roofs. Some difficulty was experienced in connection with the foundations, as the soil did not offer any resistance. It was consequently necessary to make up the ground to an average height of about 6 feet. On the small arm of the Seine there has been constructed a quay about 660 feet long, upon which there are four cranes—three electric and one worked by steam. The coal is loaded into waggons which open below, and discharge their contents either into the conveyors in the retort-houses or into hoppers on the coal-ground, shown in the upper portion of the plan. From these, it is taken by a movable transporter, 330 feet span and 80 feet high, which by means of skips, each capable of containing about 4 tons, stacks it upon the ground. Two similar transporters deal with the coke.

At present there have been erected two retort-houses, equipped with three benches of eight settings of nine 20-feet retorts, and one house with four benches of six settings. The retorts have two mouthpieces with luteless lids. There is only one hydraulic main to a bench. Each retort-house is equal to a maximum production of about 3½ million cubic feet of gas per day. The hoppers of the charging-machines are fed by a bucket conveyor; and the retorts are discharged by Boutan and De Brouwer machines. In the first houses erected, the coke on leaving the retorts fell upon moving plates, by which it was shot into a capacious channel in which it was quenched by a water-spray. It was then passed on



A. Retort-Houses Nos. 1 and 2.
B. Retort-House No. 3.
C. Exhausters.
D. Purifiers.
E. Compressing Plant.
F. Gasholders.
G. Motive Power.
H. Workshops.
I. Pitch-Pit.
J. Products Works and Water Gas Plant.
K. Coke Ground.
L. Offices.

to an elevator which raised it to the hoppers, arranged with the view of filling skips transportable by lorries to the coke-ground. In the second house, the hot coke falls direct into a hopper in which it is quenched. By this change, some saving has been effected in the dimensions of the buildings. The space in front of the retorts is the same as in the other case—about 26 feet; but on the discharging side it has been reduced from 16 feet to 11 ft. 6 in. The gas is conveyed by a large foul main into annular condensers, and drawn forward by exhausters of the Beale type worked by steam or electric motors. Their speed is regulated by an electric appliance actuated automatically by the gas pressure. The gas next passes into "Standard" washers, supplied with heavy oil, then into multitubular condensers, and finally into "Standard" washers supplied methodically with pure water and ammoniacal liquor, to extract the ammonia. Provision has been made for the erection of cyanide washers. The purifying plant is housed in two buildings, each containing eight purifiers 30 feet square, located on the first floor; the second serving as a revivifying chamber, and the ground floor as a store-room. Provision has been made for revivifying *in situ*.

The positions of the tar and liquor tanks and of the force-pumps for driving the gas into the trunk main leading to the holders are shown on the plan. Some particulars of the compressing and distributing plant have already been given in the "JOURNAL." It will be noticed that railway lines run all over the works. In an establishment of this size, the disposal and treatment of the residuals are matters of importance. The greater part of the coke, which the Company desire to sell retail, has to be broken and screened on "jigging" screens furnished with hoppers and pits. The products works will be located at the back of the station, in proximity to the water-gas apparatus. The sulphate plant consists of two columns 5 ft. 3 in. diameter; the tar-distilling plant of two 40-ton boilers and a capacious pitch-pit. The motive power necessary for driving the plant is furnished from a central electric station containing three sets of 625 H.P. turbines distributing continuous current at 500 volts.

A Curious Water Reservoir.—An old windmill at York, built of stone and now disused, is to be converted into a water tower by the Yorkshire Hennebique Contracting Company, of Leeds, who are now engaged in altering the body of the mill into a reservoir, which is being constructed entirely of ferro-concrete on the Mouchel-Hennebique system. In building this particular reservoir, the only preparation necessary was the provision of a few boards and timber supports to serve the purpose of moulds, into which the concrete is poured after the reinforcing steel rods have been laid in place.

WATER SUPPLY OF MALVERN.

By Wm. Osborne Thorp.

[A Paper read before the Association of Water Engineers.]

Mr. W. Osborne Thorp read a paper on the above subject. He said a history and description of the Malvern water supply would form a very bulky volume, and though the lessons which could be derived from it might be of considerable interest, it would be more local than general. So he commenced at the year 1892, when the principal scheme which had long received attention by the Malvern Local Board was put in hand. It consisted of the construction of a large catchment reservoir formed in a natural hollow or valley, beautifully situated below the British Camp Hill or Herefordshire Beacon, 4½ miles south of Great Malvern. An earth dam, with puddle trench of the usual type, was thrown across the valley; and the reservoir thus made was in the form of an inverted cone, which, when full, had a capacity of 44½ million gallons. The Ordnance datum of the top-water level was 667 feet; the reservoir being purposely kept at a high elevation so as to permit of water being delivered to the greater portion of Great Malvern by gravitation.

The gathering area around the basin forming the reservoir was very small, and this was augmented by catchment drains laid on the eastern slopes of the North Hill and Worcestershire Beacon. These averaged 4 to 5 feet deep, and consisted of stoneware pipes laid in trenches with open joints. The bottom half was encased in puddle, and the trench above the pipes filled in with loose stone, so that the rainfall flowing down the slopes of the hills over the hard syenitic rocks would be intercepted. As some of the catchwaters were between four and five miles from the reservoir, which was itself situated at a high level, their gathering area was, of course, of limited extent—the total being only some 387 acres. The catchwater drains discharged into a 15-inch cast-iron main which carried the water through Malvern and Malvern Wells under pressure to the main reservoir.

Two filter-beds were provided, each 55 feet by 50 feet in plan; and the clarified water was conveyed therefrom into an open service reservoir, 90 feet diameter and 12 feet deep. From this, the water was actually brought back into the 15-inch main which carried the unfiltered water from the catchwaters to the storage reservoir, and was so conveyed to the town and distributed in the service mains. Needless to say, this ingenious and economical idea was not a success; and shortly after the arrival of the author's predecessor (Mr. H. P. Maybury), a 10-inch independent supply main for the filtered water was constructed from the Camp reservoir. Thanks to a wet season, the reservoir was opened in 1894 brim full.

The population within the area of the then Great Malvern Local Board was just over 8000. The water consumption at that time, according to the meters, was about 140,000 gallons per day; and until the year 1902, though the reservoir at times ran perilously low, a wet season seems to have occurred just in time to avert a water famine, and no serious trouble had arisen.

In 1896, the adjoining Local Board of Malvern Link, which had a population of about 6000, were in difficulties about water supply, and obtained parliamentary powers to take certain springs and construct catchwater drains on the western slopes of the hills, and convey the water to a large reservoir at Parkwood, West Malvern. As works of sewerage and other expensive undertakings were looming in the immediate future, the Malvern Link and the West Malvern districts were amalgamated with Great Malvern, which had just previously absorbed Malvern Wells. With the population more than doubled, an augmentation of the water supply had to be provided without delay.

The Council immediately put in force the powers given them under the Malvern Link Water Act, and constructed the Haysladd service reservoir, fed by the spring of that name, for the supply of the upper part of West Malvern. Catchwater drains similar to those laid on the east side of the hill were carried out as shown on the deposited plans; but instead of constructing the Parkwood Reservoir, a 12-inch cast-iron main was carried through the Wyche cutting to the eastern side, and connected to the existing 15-inch main, so that the whole of the hill water collected in this manner was conveyed to the Camp reservoir, and the Great Malvern service-mains were then extended to supply Malvern Link. The discharge from the catchwaters on the west side of the hills is metered at the Wyche cutting, and the average amount collected by this means, from 200 acres, averaged only 30,000 gallons per day taken over a period of eight years.

It will be gathered, from the preceding statements, that the situation was critical for the town with its increased population; and during the dry period which occurred in 1902 the reservoir was depleted at such an alarming rate that but for the energy of Mr. Maybury in securing every available spring, well, and stream, and pumping their contents into the mains, a water famine of considerable magnitude must have ensued. Fortunately the rains set in early in September, 1902, and with the wet year of 1903 converted an empty reservoir into a full one for the first time since the opening year. To increase the storage, the earth and puddle dam at the Camp reservoir was raised 3 feet (quite up to its limit of safety), which increased the storage from 44½ to 50¾ million gallons, and an additional filter-bed was constructed.

The Council, however, recognized that further water-works were necessary, and a borehole was made on land adjoining the Link Gas-Works during 1903. This borehole, 8 inches in diameter, was sunk through exceedingly hard marl with gypsum into the new red sandstone—a total depth of 878 feet. The pumps were placed at the bottom of a well 200 feet deep and 12 feet in diameter; the water being raised to a surface tank, whence it was driven to the North Malvern service reservoir, a distance of two miles, with a lift of 480 feet. The pumps were driven by a 75 B.H.P. Tangye gas-engine taking ordinary coal gas from the Council's works adjoining. The cost of this work, with rising main, was about £7610; and it was defrayed by money borrowed for the purposes of the construction of the Parkwood reservoir.

This work had just been completed when the author took over his duties in June, 1904, at which time a severe drought occurred, following the wet season of 1903. Although the reservoir was full at the end of March, by the end of November, 1904, it was quite empty, in which condition it remained till the end of February, 1905. In the month of August, 1904, so rapid was the depletion, that the new borehole pumps were set to work; but the result was very disappointing, as, instead of yielding 225,000 gallons daily as anticipated, not more than 100,000 gallons could be pumped in 24 hours. In October, there being no sign of the hoped-for autumnal rains, all the temporary sources of supply were put into use; but these were not sufficient to stem the tide which was rapidly ebbing from the Camp reservoir.

In January, 1905, the Council were fully alive to the situation, and ordered that no expense should be spared to avert the threatened catastrophe. They had reports on the advisability of going to the new red sandstone area about 11 miles south in Gloucestershire, and a site was suggested at Bromsberrow Heath. Mr. W. Whitaker, F.R.S., having been consulted, and having endorsed the scheme, a small estate of 52 acres, known as the Grove House Farm, was purchased for £2600. Further troubles were then met with, as the Local Government Board, on being pressed to immediately sanction the necessary loan to enable the work to be put in hand, went into the whole question, and pointed out the illegality of constructing the borehole at Malvern Link, and the diversion of the catchwaters on the west side of the hills and other works, with moneys provided by the Malvern Link Water Act for other purposes. They required the Council to obtain a new Act of Parliament in which was incorporated the proposed scheme for the Bromsberrow works. This precluded all possibility of completing the Bromsberrow scheme in time for the summer of 1905, and involved the Council in serious difficulty in coping with the immediate requirements of the town.

The author at this stage recommended that a large borehole should be sunk at Malvern Link, from which water could be pumped to feed the existing surface pumps, and that in the meantime an attempt should be made to increase the quantity obtained from the 8-inch borehole by the use of compressed air. Messrs. Isler and Co. were entrusted with the sinking of a 12-inch borehole to a depth of 950 feet, lined to a depth of 710 feet, for the sum of £1790; and it was hoped this would be completed, by working continuously with three shifts per day, within six months. An agreement was also entered into with the same firm for the supply and working of an air-lift pump in place of the existing deep-well pumps. A 14-inch by 14-inch by 18-inch steam-driven air compressor was fixed, by which some 170,000 gallons of water per 24 hours were raised; the water level falling to

320 feet below the surface. It was found necessary to keep this plant running for nearly ten months; and with water obtained from numerous little temporary pumping-stations, a supply of about 230,000 gallons per day was maintained throughout 1905. It may be mentioned that the drought of 1902 and the more severe drought of 1904-5 involved the Council in an outlay of between £7000 and £8000. Meanwhile, application was made for leave to introduce a "late" Bill into Parliament, conforming with the requirements of the Local Government Board. Among the usual formalities, it was necessary to take a poll of the ratepayers; while the deposited plans and book of reference had to include not only the proposed new work, but all the work carried out by the Council in recent years. The Bill was finally approved at the end of July, 1905; and, though practically unopposed, it cost no less than £4600—a very excessive sum in view of the fact that the cost of the work authorized amounted to only £22,000. But for the technical objections raised by the Local Government Board, not only would this amount have been saved to the ratepayers, but by the earlier completion of the Bromsberrow scheme the enormous outlay in providing and maintaining the temporary supplies would also have been avoided.

After the passing of the Council's Bill, two boreholes were driven at Bromsberrow to a depth of 200 feet in the new red sandstone, 40 feet apart and 15½ inches in diameter, which on being tested gave a yield of nearly 900,000 gallons per day. The water level was 33 feet from the surface to commence with, and was only lowered about 8 feet during 14 days' pumping. It was therefore decided to immediately proceed with the works. The pumping-station consists of three buildings—engine-house 45 ft. 6 in. by 25 ft. 6 in., boiler-house 52 ft. by 22 ft., and coal-store 24 ft. by 14 ft. The chimney shaft is 80 feet high. Designed simply and plainly, the pumping-station buildings are substantial and useful, though constructed at a minimum of cost. The walls are of brickwork, on concrete foundations, with blue brick quoins and plinths; and the window and door openings are also of blue brick with bath-stone keystones to semi-circular heads. The well-pits and two surface tanks, each holding 8000 gallons, are built in cement. The foundations for the engine and pump beds are carried to a depth of over 6 feet in cement concrete, and are finished on top with thick pennant stones in order to form a firm, level bed. A neat half-timbered cottage has been provided for the use of the man in charge.

The engines are equal to about 125 B.H.P., working at a steam pressure of 130 lbs., and are of the compound coupled type, of high efficiency. Two deep-well pumps are fixed, capable of delivering 900,000 gallons per day up to the Camp reservoir. All these pumps are independent of one another, so that should any breakdown occur (say) to a deep-well pump, it can be put out of action while half the quantity of water can still be raised by the other pump till the repairs are effected. It will thus be seen that, though the plant has not been duplicated—at present an unnecessary expense—it is possible to put out of action any one of the pumps, either deep-well or surface, which may become defective, and work the others till the defect is remedied, thus obviating a complete stoppage. This point is also covered by the fact that the engines and pumps are capable of providing more than double the quantity of water required, without any other source of supply, and give a period of 12 hours in every 24 for effecting ordinary repairs. They also make a night shift unnecessary.

The details of the plant are as follows: The two well pumps in the boreholes have each a 12-inch gun-metal barrel by 30-inch stroke, and run at 25 revolutions per minute. They are driven from the engine by a mild-steel shaft and gearing; the spur-wheels having cast-iron balance-weights. Each pump is fitted with an air-vessel and relief-valve. The surface pumps are of the treble-ram type; the rams being 7 inches diameter with 12-inch stroke. Each pump body is an independent casting, making repairs easy and expeditious. The valves and seats are of gun metal, and each has an adjustable spring to ensure easy and quiet working. The cranks are of mild steel, with the three throws forged solid and slotted out. The engine is of the compound coupled type, the high-pressure cylinder being 15 inches diameter, and the low-pressure one 28 inches, with a stroke of 26 inches, and speeded at 58 revolutions per minute. The high-pressure cylinder is fitted with Meyer's variable expansion gear. The engine has on each side a fly-wheel 90 inches diameter and 10 inches wide, and is also provided with a large surface condenser having Muntz metal tube plates. In the engine-house is fixed a travelling crane capable of lifting 5 tons; so that any parts of the plant can be raised for repair or adjustment. Acetylene gas is used for lighting purposes. Two Lancashire boilers are provided, each 28 feet long by 7 feet in diameter. They are constructed of best Siemens mild steel ⅝ inch thick, to sustain a working pressure of 130 lbs. per square inch. One boiler is sufficient for the duty required; the two being worked for about a fortnight alternately. A Green fuel economizer, with 48 tubes, is fixed in the flue leading to the chimney.

The pipe-track follows the eastern slope of the hills from Bromsberrow, running due north—the total distance being 5¾ miles. The pipes are 10 inches in diameter, and were supplied by the Stanton Iron Company. They were cast in three different thicknesses and weights, according to the pressure they had to stand—viz., 0·75 inch thick, weight 6 cwt. 3 qrs. 14 lbs., working head 530 feet; 0·65 inch thick, weight 5 cwt. 3 qrs. 21 lbs., working head 360 feet; 0·57 inch thick, weight 5 cwt. 0 qr. 14 lbs., working head 230 feet. There has been no leak or breakdown on the whole pipe-line since the work was completed. The line of pipes is divided into 16 sections by 10-inch sluice-valves; and Hodson's double-action air-valves are placed wherever requisite. Automatic back-pressure valves are provided at various points, to relieve the pressure on the pipes when the engines are standing, and to permit only the section between two valves emptying in case of a burst. These back-pressure valves are bye-passed with 3-inch pipes, to allow the supply to a district or houses *en route* to be maintained from the Camp reservoir when the pumps are not working. The water on leaving the pumping-station passes through a Venturi meter, which on the several occasions when it has been tested has been found to be absolutely accurate. In an isolated spot like Bromsberrow, where supervision is difficult, the value of a self-recording instrument is obvious. The mains are so arranged that, on the water arriving at the Camp, it can be passed into the large storage reservoir or sent direct into the service reservoir below.

The whole of the works at Bromsberrow were carried out through the winter months of 1905-6, and completed within six months, though everything had to be hauled over five miles from the nearest station. The total expenditure upon them (the details of which were given by the author) was £23,582. The cost of running the pumping plant during the past summer, exclusive of capital cost and depreciation, was as follows: Steam coal (347 tons 13 cwt.), £422 16s. 3d. delivered; wages of engineer and fireman, £104; oil, waste, and small repairs, &c., £27 os. 3d.—total, £553 16s. 6d. In the period covered (seven months), 67,339,000 gallons of water were raised to the Camp reservoir; the working cost being 1·97d. per 1000 gallons.

The author closed his paper with a few remarks in regard to the distribution works at Malvern. With a difference of over 900 feet in the levels of various parts of the district, which extends over an area of 5200 acres, it will be readily understood that the difficulties of distribution are considerable; but by means of service reservoirs at several levels, this difficulty has been overcome, though pumping is necessary to reach the highest points. The pressure in the mains varies from 10 to 215 lbs. per square inch. With regard to charges, the Malvern Water Acts give the Council the option of charging by meter or by rate; and since 1894 the whole of the supply, both for domestic and other purposes, has been by meter. Until within recent years the charge has been 1s. 3d. per 1000 gallons; but, owing to the heavy expenses recently incurred, the present rate is 1s. 8d. The average consumption is only 16 gallons per head in the winter, 18 gallons in the summer, and 20 gallons whenever heavy quantities are required for street watering. The low consumption in Malvern is doubtless attributable to the extra care exercised by consumers in the use of water, and to the discovery and repair of defective fittings, due to the knowledge that every drop of water wasted has to be paid for. Again, in a town like Malvern, where gardens are so essential a feature of the place, the use of water therein would be far beyond any return obtainable by a fixed rate on the usual scale.

As regards meters, there are about 2050 in use, of which 1870 are of a type which, though rather expensive, has been found to be the most reliable and accurate in ordinary use. The cost of upkeep is rather difficult to ascertain accurately, but, including labour in fixing and changing the meters, the annual cost is £115 for labour and about £42 for renewals;

making a sum of 1s. 6½d. per meter per annum. The capital outlay on meters is at least £8200; while the income per annum is £872, from which must be deducted £157 working expenses; leaving a balance of £715 per annum, which does not cover the interest and 10 per cent. depreciation on the outlay. It is interesting to note that the charge of 1s. 8d. per 1000 gallons and 8s. for meter-rent, which is apparently high, only represents a rate of 1s. 1½d. in the pound on the assessable value of the houses supplied.

Discussion.

The PRESIDENT (Mr. Christopher Sainty) said he thought there was a lot of useful information in the paper. He was rather surprised to find that in such a wealthy district the consumption worked out to an average of 16 gallons per head per day. The inhabitants must be very economical there, more especially seeing they had rather large gardens. Another astonishing point was that some of the work described came out so cheap. He (the President) could not understand how this was; there must be some very cheap labour in that part.

Mr. S. R. LOWCOCK (London) said the author mentioned an extraordinary connection which was made from the service reservoir back into the 15-inch main, which carried the unfiltered water to the storage reservoir. He (Mr. Lowcock) could not understand what was really meant. So far as he gathered, the water was first of all taken through the filters, then taken back, mixed with the unfiltered water, and sent to the town. If this was the true interpretation of the statement, the proceeding was improper. He disagreed with the author when he said that the history of the Malvern water supply would be of more local interest than general. What the author had told them had been very interesting; but if he had gone back a little farther, that history would be found even more interesting, because the history of the Malvern Water-Works was really an illustration of being penny wise and pound foolish. This was why an extraordinary cost had had to be incurred for this scheme, or rather for a series of schemes, to get over the troubles the Authority brought upon themselves. He entirely sympathized with Mr. Thorp and his predecessor (Mr. Maybury) in having to carry out works—permanent as well as temporary—and adopt all sorts of expedients while the Authority were in a state of panic, and practically all due to their own fault. As to the pumping plant in the existing scheme, he was not quite sure whether there were two engines or one; but he rather gathered there was only one. Mr. Thorp provided two sets of pumps, so that if anything happened to one, the other could take on the work. But what happened if the engine broke down? There was another point in connection with the engine, pumps, and boilers. They were all capable of doing twice as much work as was wanted. It would have been more economical, from the working expenses point of view, as well as better generally, to have had two engines, and then either engine could have worked at its most economical rate. The present engine was going at only half its power; and so it was not working so economically as it might do under other conditions. This accounted for the cost of pumping, which was about ¼d. per 1000 gallons lifted 100 feet high. He (Mr. Lowcock) thought the cost should be considerably lower than this. With reference to the meters, the upkeep seemed very economical indeed; and he should like to know how long these meters had been at work. It might be that the low cost was partly due to the meters not having been very long in use, and consequently the author did not get so many changes as there would be in course of time. With reference to the cost of the water, the author stated that the charge per 1000 gallons and the meter-rent represented a rate of 1s. 1½d. in the pound on the assessable value of the houses supplied. In addition to this charge, there was a general district rate of 6½d. in the pound. He presumed this was over an area in which all the houses were not connected up; and therefore, taking it roughly, probably the real rate, instead of being 1s. 1½d., would be about 2s. It would be 10 per cent., instead of rather more than 5 per cent., on the rateable value of the premises supplied.

Mr. W. G. PEIRCE (Richmond) said he was interested in the meter question. He noticed that the author only put down 1s. 6½d. for meter repairs. This was a very low cost. The author did not give the name of the manufacturers; but anyway the meters were most economical. There was one other matter which always seemed to be in the way of introducing a meter supply into a town or village—that was the supply of water to cottages. He should like to ask the author how he managed to get over the difficulty of supplying water to cottage property. Occupiers of such property used a large quantity of water, particularly if they took in a little laundry work; and they could not afford to pay for it by meter. Was there any minimum charge on the meters? He found it was necessary to charge a minimum on all the meters, so as to get over the difficulty of a small consumption. Some only required water for accommodation when a private source failed.

Mr. J. S. PICKERING (Cheltenham) said he gathered that the author had one engine and two sets of pumps; and he agreed with Mr. Lowcock that it would have been preferable, and more economical, to have had an engine to each pump. The cost of 1·97d., or practically 2d., per 1000 gallons for pumping seemed to be high. Mr. Thorp, in his paper, mentioned that all the property in the town was supplied by meter—that was, the cottages as well as the larger residences. If this was so, and the consumption was something like 18 gallons per head, at 1s. 8d. per 1000 gallons, this meant that every cottage supply (reckoning five persons to a cottage) would cost about 1s. per week, whereas it had been laid down by legislation that cottage supplies should be given at something like 2d. or 3d. per week. He did not agree with Mr. Thorp that the supply in residential towns was something like 10 gallons per head in excess of Malvern. He should like to know his authority for making such a statement. His last point was this: Considering the Severn was within five miles of Malvern, why had not a supply been taken from the river? The Severn water was excellent for domestic use; and why all this capital expenditure had been entailed, and the inconvenience suffered for so many years with such a supply close at hand, he could not conceive.

Mr. H. ASHTON HILL (South Staffordshire Water-Works Company) said his first question was, Why were 52 acres of land bought at Bromsberrow? Why did not the Council buy the 2 acres, and leave out the 50 acres, and so save the capital expenditure of £2600? There might be some special reason for it; but he should have thought that if the Council had paid (say) £200 for 2 acres, they would have saved money. With Mr. Lowcock, he thought from what had happened at Malvern, more blame attached to the Council than to the Local Government Board. As to meters, he agreed with what was the general view, that they were expensive and often unsatisfactory. As to the engines, he should like to know whether Mr. Thorp was thoroughly well pleased with the design of the plant, whether it worked nicely and smoothly, or whether the gearing could be heard half-a-mile off. The next question was as to the lighting by acetylene gas—whether Mr. Thorp was pleased with it, what the installation cost, and what were the lighting costs. He (Mr. Hill) had gone into the question of different systems of lighting; and, for cheapness, there was nothing to compare with oil. With regard to the pipe-line, he saw it was constructed on the latest scientific principles, just the same as if it were a 42-inch pipe. He saw the thicknesses of the pipes were worked out very carefully to the different heads the pipes had to bear. Could not such refinement as this be carried too far? He would suggest that, if a pipe ⅝-inch thick had been adopted throughout, instead of pipes of different thicknesses, it would have been better. Mr. Thorp also told them that he had put in automatic back-pressure valves to relieve the pressure on the pipes when the engines were standing. At the same time, he told them he had a bye-pass round the valves, so that they did not achieve the object for which they were put in. It must not be imagined that he (Mr. Hill) was contending that these valves should not have been put in, but only that Mr. Thorp appeared to be defeating the objects—or rather one of them—for which they were intended. As to the working costs, it would have been much better to express them in some standard terms referable to other installations. With regard to the low consumption of water per head of the population, he supposed this must be taken relatively. It was a low consumption for a town like Malvern. In the district with which he (Mr. Hill) was connected, the consumption for domestic purposes was under 16 gallons. It was not all a high-class residential area. Some of the towns were residential, and others were not; and it was interesting to compare his figure to show that, where all the water, as in Malvern, was metered, and making allowance for the difference of the towns, the consumption came to between 16 and 18 gallons, and in other towns, where there was unrestricted use of water, no meters at all for domestic supplies,

and only ordinary waste inspection, the consumption was down to the same figure. It would add to the usefulness of the paper if Mr. Thorp would give them an analysis of the water he obtained at the borehole.

Mr. F. J. Bancroft (Hull) said he should like Mr. Thorp to tell the members about the origin of the meter system at Malvern, and whether it was compulsory for the consumers to take water by meter, or whether they had the opportunity of taking it by assessment. He was struck by the economical upkeep of the meters. Perhaps Mr. Thorp would tell them the size he used, as the figure was remarkably low. He (Mr. Bancroft) had a meter department at Hull; and the costs were very carefully kept. With 1230 meters, the average cost per meter for labour and details amounted to 7s. 2½d., and inspection to 2s. 10½d.—a total of 10s. 1d. Depreciation came to 8s. 9½d.; so that the total charge per meter was 18s. 10½d. They received meter-rents amounting to £1057; and they spent £1157 to earn it, so far as upkeep, inspection, and depreciation were concerned. Mr. Thorp's consumption per meter was, no doubt, very small. He noticed that he sold 67 million gallons in seven months. At Hull, through the 1230 meters, they sold 828 million gallons, or over 673,000 gallons per meter. The sizes of the meter to which the above averages referred ranged from ⅜-inch to 6-inch. Probably at Malvern they were all small.

Mr. J. F. Cullen (Deal) inquired whether the type of meter used in Malvern was inferential or positive.

Mr. A. B. E. Blackburn (Sunderland) inquired whether the meter-rent was a uniform one for every size of meter—viz., 8s. per annum. That rent represented nearly 2d. per week. Therefore, if the small water consumer had to have his supply at a cost not exceeding 2d. per week, the water would practically have to be furnished free. There was an item in the costs for extraordinary traffic. He would like to know from Mr. Thorp how the amount for this extraordinary traffic was made up.

Mr. W. Matthews (Southampton) asked whether the annual cost for the meters was ascertained from a single year's working, or the average of a number, because if it was taken for last year, or for several years past, consideration had to be given to the fact that there had not been anything like an extraordinary winter. In one severe year, they might have casualties connected with their meters which would raise the total cost per annum perhaps 100 or 200 per cent. With regard to the land purchased for the pumping-station described by the author, he thought Malvern was exceedingly wise in buying the 52 acres of land while they were about it. As to the cost of promoting the Bill—£4600—he did not quite understand why a technical objection of the Local Government Board should raise the cost to so extraordinary a sum. However, such an expense was serious. The Local Government Board would only be likely to oppose on the ground that they were afraid, from prior experience, that this tardy move on the part of Malvern might not be of a satisfactory character; and they had to see that the ratepayers' interests were guarded.

Mr. H. E. Stilgoe (City Engineer, Birmingham) remarked that he had just a few words to say on the main principles of the paper. It appeared the local authority of Malvern began by taking a gathering-ground at the head of the area. They had, however, apparently two other ways open to them—one was to take water from the river; the other was to take it from the borehole, which they did. The fact which had great interest for him was this, that the area chosen in the first instance—587 acres—showed itself to be a good one, capable of supplying a deep spring, but a poor one for a catchment scheme. The point which appeared to him to be particularly useful in this respect was that, whereas from the 200 acres and 26¾ inches of rainfall per annum they only got 30,000 gallons per day (which was only about one-eleventh of the fall), on the total 587 acres they obtained 174,000 gallons per day, which was equal to between one-fifth and one-sixth of what fell. The useful lesson this appeared to point out to him was that, whereas off about one-third of the area the quantity flowing and collected was comparatively small, on the remainder of the area it was much greater. This showed that, in selecting a catchment scheme, one had to be very careful not to consider it in so many acres, but in what the formation was.

Mr. F. W. Hodson (Loughborough) said he quite agreed with Mr. Pickering that it was impossible to form any real judgment as to the efficiency of the engine from the figures in the paper; but it was equally impossible to form a judgment in regard to the cost of pumping the water from the fully corrected figures of a test. An interesting point in the paper was the substitution of the air-lift for the ordinary pumps at the Link borehole, by which the yield increased from 100,000 to 170,000 gallons per day. This increase of 70 per cent. in the yield appeared to have been obtained by lowering the point of suction 60 per cent. Another matter he would like to refer to was the rainfall, where the author again confirmed the well-known fact that summer rainfall was of little value for water-works purposes; and that a year of average rainfall as ordinarily recorded might mean a serious deficit. Valuable rainfall records were kept by almost every water engineer, and by the British Rainfall Organization; but these returns were only available for the calendar year. He had for some years been gauging a watershed at a point at which, owing to the natural conditions, unusual facilities existed for measuring the total flow from the area; and it was interesting to note that in January and February one might, in some years, obtain 100 per cent. of the rain, while in July, August, and September the flow might reduce to 5 per cent. It would be of great value if the Association would bring pressure to bear to obtain the publication of rainfall returns in some form which would still further increase their usefulness to water engineers.

Mr. C. F. Gettings (Teignmouth) said the author had given the rent of meters as 8s. per annum; but the size of the meter was not stated. He assumed it was ½-inch; and, if so, the charge was very reasonable. He would like to know the initial cost per meter. They were all aware that the price of ½-inch meters varied from 30s. to £5 or £6; and the initial cost must to a certain extent control the annual rent charged.

Mr. H. Preston (Grantham) remarked that the author gave 17·8 gallons as the average consumption per head per day. He also stated that the whole of the water, on leaving the pumping-station, passed through a Venturi meter, which, upon being tested, had been found to be "absolutely accurate." Did the 17·8 gallons include any slip on the domestic meters? If so, what was the amount. If not, was not the 17·8 gallons too low a figure for the rate per head per day for these particular houses? Could the author tell the members what was the usual condition of the meters when taken out for repairs?

Mr. W. Whitaker, F.R.S. (Croydon) said that in the discussion some of the members had forgotten, or did not understand, that this new supply from Bromsberrow was by no means the whole supply of Malvern. It was practically a stand-by; so that it was not necessary to have a duplicate engine. This stand-by supply would be used when the water in the Camp reservoir showed signs of failure. In a fairly wet year, there would be plenty of water in the reservoir; and the moment the supply went down, they would begin pumping at Bromsberrow. Regarding the cost of parliamentary work, it was a hard thing that an authority should have to spend so large an amount in such a way. It was a crying evil; and he hoped it would be redressed. As to the area of land, he certainly advised that the whole of the estate should be taken. It was very cheap; and it did not include the 52 acres only. There were on the site an old manor house and farm buildings; and it was advisable to have control of these. It would not have done to have had a careless farmer near at hand possibly polluting the supply. In his (Mr. Whitaker's) view, a company or a corporation were justified in spending a fair amount of money in buying a fair amount of land; and he thought that the Corporation in this case got the land and its belongings remarkably cheap, and that they would never regret it. He was sure protective measures for ensuring the non-pollution of water were almost as important as the measures taken to get the water itself. There was one point in the discussion to which he must take strong objection. One gentleman, he was sorry to see, stood up for waste. He (Mr. Whitaker) objected to waste in every way. There was only a limited amount of water in the country, and there were practically almost unlimited attempts to get it. He felt sure one of the great problems that was coming before all water engineers very soon would be how to reduce expenses by stopping waste, not by stopping the legitimate use of water. If there was a legitimate use of 30 or 40 gallons, by all means supply this quantity; but if 10 gallons could be saved, the best way to spend money would be in saving this 10 gallons. He hoped they would all think over the matter, and would see that it was one of the most important things that would be before them henceforth. They had heard in the case of parts of London that a consumption of 35 to 40 gallons had

been reduced, by proper control, to 25 gallons; and the people were just as satisfied.

The PRESIDENT said they had had an excellent discussion; and, to economize time as much as possible, he would ask Mr. Thorp to communicate his reply to the Secretary, for inclusion in the Transactions.

Mr. THORP, in the course of his written reply to the different speakers, said, with reference to the arrangement at the Camp reservoir by which it was proposed to convey the filtered water back to the town by means of the same 15-inch pipe which carried the unfiltered water to the reservoir, that probably the real reason for the return service main not being laid in the first instance was a question of estimates and of finance. Referring to the Bromsberrow pumping plant, he said that, with an ordinary type of compound condensing engine, there was very little to break down; and any necessary repairs were not likely to occupy more than a few days at most. Considering the fact that the plant, if working continuously without any other source of supply, was capable of yielding nearly three times the average demand, he did not deem it advisable to duplicate the engines, as the town would always have from 40 to 60 million gallons of water in reserve at the reservoir. The total lift was 640 feet, which gave a working cost of about 0·3d. per 1000 gallons raised 100 feet. A water-rate to cover the whole of the expenditure on water would amount to about 1s. 8d. in the pound, not 2s. as suggested by Mr. Lowcock. As to the cost and upkeep of meters, nearly every type of meter was in use; but about 90 per cent. were of one make, which, though expensive in initial outlay, had proved to be the most economical in the long run. The cost of a ⅜-inch meter, which was the usual size, was £4 0s. 9d.; while a ½-inch meter cost £4 12s. 2d., and a ¾-inch £6 13s. All the meters were of the positive type; the inferential ones proving unsatisfactory for small and irregular flows. With regard to the figures for the repairs to meters, he omitted to state that an average of £520 per annum was spent on replacing meters past repair. The sum given was only for renewals of parts in the actual repair of the meters. If the new figure was included, the total cost per annum averaged 6s. 8d. per meter. Property of the cottage class was charged half-rates. In the majority of cases, one meter served any number from two up to twenty cottages; and in such instances the landlord paid. In reply to the question as to whether the use of meters was compulsory, the Council might either charge by meter or on the rateable value of the premises; but this was for them to decide—the consumer had no choice. The 17·8 gallons referred to by Mr. Preston was the net amount registered on a number of new meters recently fixed and tested accurately. The original reason for the use of the meters was the extreme value set on the hill water by the promoters of the catchwater scheme, who no doubt considered measurement the best method of preventing waste and shortage. As to the high cost of the Act of Parliament, the investigation the scheme received at the hands of the Lords Committee was not 1 per cent. of what it would have had at a Local Government Board inquiry; whereas the cost was perhaps twenty times as great. With reference to the pressure, the Council made a uniform rule that 7-lb. lead pipe should be used for all ½-inch services, regardless of pressure. As to taking a supply from the Severn, he feared he could not agree with Mr. Pickering that what was good enough for Cheltenham was good enough for Malvern. The new red sandstone area at Bromsberrow was six miles from the Camp reservoir. The nearest point on the Severn was the same distance off; and the pumping head would be about the same. The Bromsberrow supply, however, was of undoubted purity, and could be used without filtration. The nearest point on the Severn would be about five miles below Worcester, where a city of over 50,000 inhabitants daily discharged a continuous volume of absolutely untreated sewage. From a return recently obtained from some 25 health resorts and seaside residential towns in the country, the average consumption of water was found to be slightly over 28 gallons per head per diem, or, as stated in the paper, 10 gallons in excess of that consumed in Malvern. Mr. Ashton Hill mentioned the purchase of 52 acres of ground at Bromsberrow. It was a small farm bought for the Council by a farmer as a farm, and not as a site for a valuable water-works undertaking. The remaining 48 acres were let off, and paid more than 5 per cent., while the Council exercised control over a considerable area round the boreholes. The cost of the installation of acetylene gas was £90, including house; while the gas generated was equal to coal gas at 3s. 6d. per 1000 cubic feet. Referring to the pipe-line from Bromsberrow, various thicknesses of pipes were distinguished by means of marks "A," "B," and "C" cast on each pipe. They were stored in convenient spots close to where they were likely to be required; so that there was no fear of a man placing a light pipe where a heavy one should be. As to the cost of lifting the water from the Link borehole by compressed air, this was found to be a most expensive matter, averaging more than 6d. per 1000 gallons. But the work was of a temporary nature; and as it was impossible to get one portable boiler large enough to lift the water 350 feet, two were employed, and a good deal of waste occurred in consequence. Under ordinary circumstances, he would prefer pumps. Mr. Blackburn had referred to the extraordinary traffic. In the Bromsberrow case they had to pay the Hereford County authorities a sum of more than £200. Yet further on, where exactly the same traffic occurred, the Worcester county road authority did not bring forward any claim; and much heavier traffic on the Gloucester county roads did not produce any complaint or charge whatever. In conclusion, Mr. Thorp thanked the President and members for the instructive discussion which had taken place on his paper.

REPAIRING A LEAKY RESERVOIR.

A leak which existed in the embankment of the Hope reservoir at Providence (R.I.) for more than 25 years gave the officials of the Engineering Department of the city considerable trouble before its course was finally traced. The reservoir is a service basin surrounded by dwellings. The leak appeared originally at the foot of one of the slopes, where a pipe well was constructed to intercept the seepage and direct it into a sewer. Measurements of the discharge were kept for some time, and during the last few years the amount had increased somewhat, though not enough to cause alarm. Many examinations had been made, and much time and money expended, without finding any clue to the point on the inside of the bank where the water escaped. In May of last year the water was drawn off for the purpose of cleaning the reservoir, and advantage was taken of this opportunity to investigate and repair the leak. The work is described by Mr. Otis F. Clapp, the City Engineer, from whose report the following particulars have been reproduced in a recent number of "Engineering Record."

It was thought that the best way to trace the course of the water would be to follow the stream back into the bank. When the water had been drawn down so that there was a head of about 1 foot on the discharge, digging was commenced. Almost immediately a water channel was found, measuring from 2 to 4 inches in height and from 4 to 8 inches wide, and nearly level. This was followed some 54 feet in open trench, and then tunnelling was commenced. When a point was reached about under the outer top edge of the embankment, the channel divided, and ran in nearly opposite directions. In the belief that time could be saved by so doing, a lot of coloured water was forced back into the reservoir by way of each of these two routes; but the colour appeared at the same point on the surface of the water.

The reservoir was then emptied and cleaned, and the tunnelling was continued by way of both branches. The stone slope wall was taken down where the coloured water had appeared, and a hole was found several inches in diameter, which went back into the bank for some distance, and then branched and ran in opposite directions. The tunnelling was prosecuted until the lines met—every effort being made to discover any side openings that might lead away. Only a few were discovered; and these were followed to the end. The material of the embankment was found to be hard and in the best condition. Only a few soft places were discovered; and these (all near the watercourse) were completely removed. The tunnel averaged about 4 feet high and 2 ft. 6 in. wide—just large enough for a man to work in. It measured 251 lineal feet, with 54 feet of open cut. There were discovered 359 lineal feet of watercourse in the embankment.

It was not thought safe to refill the tunnel, and so the portion of the bank lying over the tunnel excavation was taken out and the embankment rebuilt. The water channel was found to be about on the surface of the original soil, or where the artificial work in building the embankment was begun. In repairing, the precaution was taken to go down lower in the line of the core wall, finding rock from 2 to 5 feet below where the embankment had been started before, and filling in with cement concrete. The excavation was then refilled with great care; some three carloads of clay being added to the soil taken out before replacing. The work of repairing took about 3½ months to perform, and no sign of any leak has since appeared at this point. A smaller leak or spring, co-existent with the other, is still discharging near the corner of the reservoir. This is to be examined later.

SOME METER DEVELOPMENTS IN AMERICA.

[COMMUNICATED.]

THOSE persons in direct charge of the distribution, and more especially the meter department, of a gas company appreciate the expense entailed by the necessity for measuring gas. In some cases the meter costs more than the service, and as much as the main, necessary to supply a new consumer. Also, the expense of maintaining existing meters in good condition is one of the large items of distribution cost. These facts afford ample justification for calling to the attention of your readers some developments now taking place in the United States, which are confidently expected to largely reduce future capital investment in new meters, and in certain localities to effect large savings in the operating and maintenance costs of the meter department.

First, as to the saving in new meters. It will be remembered that, in 1904, a paper was read before the American Gaslight Association by Mr. B. H. Spangenberg, in which he advocated that existing sizes of meters be replaced by four new sizes—viz., 5-A, 30-A, 60-A, and 150-A. The numeral opposite each size indicates that the connections and size of case are similar to the meter now in use of the same numeral. In other words, a 5-A meter has the same sized connections and screws as a 5-light meter. For details as to how the increased capacity was obtained, reference should be made to the abstract of the paper as published in the "JOURNAL" for June 20, 1905, and the accompanying editorial note.

Now let us see what has been accomplished in three years. In a communication presented to the American Gas Institute last October, and which has recently appeared in the American gas periodicals, Mr. Serrill states that up to date the United Gas Improvement Company have bought about 22,000 "A" meters. These meters are mostly of the 5-A size, and are used where 10-light, and in lesser number where 20-light and 30-light meters would be required. When it is known that a 5-A meter costs possibly a shilling more than a 5-light, readers may figure out how large has been the saving effected by the purchase of these 22,000 meters, even if considered as displacing 10-lights only. The purchases of "A" meters by other companies have undoubtedly been considerable. Appreciating the trend of events, various meter manufacturers have begun to make and sell in quantity meters in which from the standard sized cases an increased capacity is obtained, though usually such capacity is not equal to that of the "A" meter. Therefore, it would seem that the question has passed the experimental stage, and that all large gas companies should take steps to ascertain what saving might be expected if they were able to buy "A" meters, instead of the ordinary type, in sizes greater than 5-light.

Coming now to the question of decreasing maintenance costs, a paper was read in 1906 before the American Gas Institute, by Mr. J. M. Rusby, in which he decribed the results that had been attained to date and those that were expected to result in the future, from the practice of introducing into all meters enough of a neutral oil to ensure the constant immersion of the lower end of each diaphragm. Such a diaphragm is called a "dipping" diaphragm; and the meter, a "dipping" meter. For further particulars, reference should be had to the paper itself. The paper was hailed with delight by those companies who were making water gas with Texas oil, and were experiencing much annoyance, and suffering considerable expense, from numerous "bleached diaphragms." Within three months—viz., in January, 1907—the Baltimore Gas Company began to convert their meters into "dipping" meters—a practice which had been in vogue in Philadelphia since July, 1905. During 1907, several other companies began experiments along this line; and at the present time there are probably more than 200,000 dipping meters in the United States, and judging from the testimony given at the last meeting of the Institute in the short papers read by Mr. Castor, of Philadelphia, and Mr. Beadenkopf, of Baltimore, the number is apt to increase at a rapid rate. One of the benefits derived from the introduction of the oil will appeal strongly to every meter repairer, and is thus described by Mr. Castor:

> "The non-dipping meters removed from service, and proving within the adjustment limits, are not subjected to the slow-motion test until after the oil has been put in the meter. A careful investigation has shown that more than 50 per cent. of the slow-motion leaks on non-dipping meters will be remedied simply by the absorption of oil by the diaphragms. The diaphragms are undoubtedly preserved by the oil, which keeps the leather soft and pliable, and protects it against the action of the gas vapours."

A careful perusal of the "dipping" meter literature, as mentioned above, will at least afford interesting reading to every man who is responsible for meter repairs; and if our American experience is any criterion, it will put him into a position for making some experiments, which afford possibilities of reducing operating costs.

South East of Ireland Gas Association.—A quarterly general meeting of this Association will be held at the Waterford Gas-Works on the 5th prox., when a paper on "The Relation between Labour and Wages" will be read by Mr. J. Richmond, of Kilkenny; and the question of the relative value of iron and compo pipes for internal fitting work will be discussed.

PHILADELPHIA EXPERIENCE WITH "DIPPING METER" DIAPHRAGMS.

By W. A. CASTOR, of Philadelphia, Pa.

[A Paper written for the American Gas Institute.]

On Sept. 1, 1907, there were 127,000 meters containing neutral machine oil—about 45 per cent. of the total meters in service. The system of introducing oil into the meters was started on July 1, 1905, at our meter-repair shop, and in the six district meter shops a year later. All meters are now oiled before they are put in service. Meters, 150-light or over, are sent to the repair shop for testing and oiling.

A ¼-inch hole is punched in each side of the partition on the outlet side of the meter, midway between the partition and the front and back cases, and ¾ inch above the bottom. The meter is drained if necessary, and a measured quantity of oil (as shown in the table given below) is poured into each diaphragm chamber through the punch holes.

In some meters the diaphragms are set by the manufacturers to clear the bottom of the meter. This clearance varies greatly in different makes of meters. When the meter cases are not removed, or the height of the diaphragm is not definitely known, it is our practice to place an extra quantity of oil in each diaphragm chamber to insure the diaphragms dipping in same, and then sweat in a round-headed tinned rivet in each punch hole. These meters are then known as Class No. 2 meters. When the diaphragms are exposed, and the clearance between the bottom of the diaphragm and the bottom of the meter is 3-16ths inch or less, a minimum quantity of oil is put in, and a flat-headed, tinned rivet is sweated in each punch hole. These meters are then known as Class No. 3 meters. Meters that have not had oil inserted are known as Class No. 1 meters.

Quantities of Oil poured into Each Diaphragm Chamber of Class No. 2 Meters, or when Making a Meter Class No. 2:

Size of Meter.	Quantity of Oil. Ounces.
3-light ..	20
5 ,, ..	24
10 ,, ..	34
20 ,, ..	22
30 ,, ..	68
45 ,, ..	38
60 ,, ..	47
100 ,, ..	60
150 ,, ..	98
200 ,, ..	98
300 ,, ..	124

Quantities of Oil poured into Each Diaphragm Chamber of Class No. 3 Meters, or when making a Meter Class No. 3:

Size of Meter.	Quantity of Oil. Ounces.
3-light ..	10
5 ,, ..	10
10 ,, ..	16
20 ,, ..	22
30 ,, ..	32
45 ,, ..	38
60 ,, ..	47
100 ,, ..	60
150 ,, ..	98
200 ,, ..	98
300 ,, ..	124

Samples of the oil are taken from the shipments received, and submitted to our Chief Chemist to be tested for acidity, viscosity, and congealing point. There has been no trace of acid found in any of the samples submitted to date. The specific gravity of this oil is ·87; the congealing point is 35° to 38° Fahr. viscosity 1·9 at 100° Fahr.

Oil drained from meters brought in from service is not used again in the meters, as it contains more or less condensation.

The practice of introducing oil into the meters has resulted in a great reduction of the number of meters sent to the repair shop by the district shops. During the period covered by this report, the tests of all meters made in the district shops resulted in the sending to the repair shop of about 3 per cent. of the dipping meters, and 11 per cent. of the non-dipping meters. As all meters will be changed to the dipping classes within a few years, it is plain a considerable saving will be effected.

The non-dipping, or Class No. 1, meters removed from service, and proving within the adjustment limits, are not subjected to the slow-motion test until after the oil has been put in the meter. A careful investigation has shown that more than 50 per cent. of the slow-motion leaks on Class No. 1 meters will be remedied simply by the absorption of oil by the diaphragm. The diaphragms are undoubtedly preserved by the oil, which keeps the leather soft and pliable at all times, and protects it against the action of the gas vapours.

A recent examination of a number of diaphragms, which had been in the meters from two to ten years previous to oiling, and one-half to one-and-a-half years after being made "dipping" diaphragms, showed the leather in each diaphragm thoroughly saturated with oil, and no evidence of any injurious action due to the neutral machine oil. Diaphragms originally oiled with neutral machine oil, and which have been in service for two years or more, show no depreciation on examination.

An investigation, covering a period of several months, showed that the oil, when introduced into non-dipping, or Class No. 1, meters, removed from service, caused a marked change in proof after standing from ten to twenty days after the oil was put in. Slow meters proved faster, and fast meters generally proved slower.

This information enabled us to make a change in the O. K. limit of error previous to taking off the top for adjusting purposes—thus taking advantage of the effects of the oil, and thereby saving the expense of unnecessarily taking off the tops of a large number of Class No. 1 meters for adjusting.

A considerable saving is effected at the repair shop, due to the fact that it is not thought necessary to expose and examine the

diaphragms of dipping meters received from the district shops, unless the tests warrant such procedure; while, on the other hand, diaphragms in non-dipping meters, which had been in service six months or more, were exposed, and in many instances renewed. We are thus enabled to save the expense of removing and replacing the cases and the frequent renewal of diaphragms; feeling safe in allowing the dipping diaphragm to remain in the meter until a test shows that it actually demands attention.

It is important that enough time should be allowed for the oil to saturate the diaphragms of Class No. 1 meters changed to Class No. 2, before making the check-test after putting in the oil. Ten days is sufficient time for meters 10-light or smaller, and twenty days for meters 20-light to 100-light inclusive. If longer time can be conveniently allowed for 60-light and 100-light meters, it is advisable to do so. It is doubtful if the oil will reach the top of diaphragms of 150-light meters or larger when the leather has been bleached and the pores of the leather are more or less choked up. Experiments are now being made to lift the oil to the top of the diaphragm of large meters by some mechanical means.

The following comparison of proof of dipping meters as compared with proofs of non-dipping meters after removal from service, shows the decided superiority of the dipping meters:—

Comparison of Tests of Dipping and Non-Dipping Meters.
(Jan. 9, 1906, to Jan. 9, 1907.)

	Dipping.	Non-Dipping.
Number tested	12,876	51,041
Average error—per cent.	1·60	2·9
Net error—per cent. slow	0·77	1·5

The net error of dipping and non-dipping meters from July 1, 1905, to Sept. 1, 1906, is as follows:—

	Dipping.	Non-Dipping.
Net error—per cent. slow	0·74	1·0

The net error of dipping and non-dipping meters from July 1, 1906, to Sept. 1, 1907, covering the entire dipping period, is as follows:—

	Dipping.	Non-Dipping.
Net error—per cent. slow	0·76	1·3

The following shows the percentages, by class, of the total meters removed from Jan. 1, 1907, to Sept. 1, 1907, which tested within correct limits—*i.e.*, 1 per cent. fast or 1½ per cent. slow:—

No. 1 (Non-Dipping) 33·4 per cent.
No. 2 (Dipping) . . 66·5 ,,
No. 3 ,, . . 68·6 ,,

The Class No. 2 meters may be safely said to compare with Class No. 1 meters, as to age of diaphragm and of meter. We may therefore expect that the results of the tests of Class No. 2 meters are what we may anticipate from all meters in the long run after reaching the oiling or dipping basis.

The following table shows the percentage of each class of meters removed and tested from Jan. 1, 1907, to Sept. 1, 1907, that was sent to the repair shop from the district shops.

67 per cent. of Class No. 1.
26 ,, Class No. 2.
20 ,, Class No. 3.

A like summary for the month of August shows:

67·0 per cent. of Class No. 1.
15·5 ,, Class No. 2.
8·0 ,, Class No. 3.

Our experience has proved that dipping meters record within smaller limits of error; that diaphragms are preserved; that the proof of the meter remains fairly constant under all conditions; and that cost of repairs, which were formerly due to diaphragm troubles, has been greatly diminished. All the advantages claimed for the dipping of diaphragms in oil by Mr. John Rusby in his paper read before this body last year, have been fairly realized in actual practice.

"DIPPING METERS" AT BALTIMORE.

By Geo. Beadenkopf, of Baltimore, Md.

[A Paper written for the American Gas Institute.]

On Jan. 3, 1907, this Company began using in its consumers' meters "dipping oil;" this oil being known commercially as No. 4 neutral machine oil—an oil free of acid. The oil is introduced through two holes near the bottom of the meter; and an amount sufficient to allow the diaphragms to dip into it about 5-16 inch is placed in each meter. The quantity for a 5-light meter is about 20 oz., or 5 gills, where the diaphragms do not drag on the bottom of the meter.

After the oil has been placed in the meters, and the holes closed with rivets (the rivet-heads being covered with solder to make them tight), and before the meters are placed in service, they are set aside for about three days to see that no oil leaks out of them.

From Jan. 3 to Aug. 15, 1907, 16,766 gas-meters have been oiled and placed in service; and of this number 304 have been removed for various causes. The average test for these 304 meters (some of them having been "O. K." meters when they were set) was 100·69; and when removed, the average test showed 100·72. Of the meters removed, 275 ranged between 98 and 102.

Of the oiled meters examined, which had been brought in from service, there have been no signs of bleaching of the diaphragms; whereas meters which have not been treated with oil, frequently show signs of bleaching after several months' service.

Of oiled meters which have been brought in from service and opened, and have been exposed to the air from two to five days, the diaphragms showed no signs of drying out or bleaching, but remained soft and pliable.

The amount of oil and condensation discovered in meters after from three to six months' service (varying as to the location of the meter) has been found to be about 25 oz.—an increase over the amount of "dipping oil" originally put in of about 25 per cent. This mixture will sometimes flash when passing a light over it. It has been the practice with meters brought in from service, to replace this mixture with fresh neutral oil in all which have been in service three months or over.

There were brought in from service and tested, 117 meters, unoiled. These were found to test between 99 and 102; were treated with oil and set aside in the shop for ten days; and again tested, with the following result:—

No change from original test	33 meters
Went faster than original test	37 ,,
Went slower than original test	47 ,,
Average of tests before oiling	100·15
Average of tests after oiling	100·31

In all of the meters referred to as having been treated with neutral oil, the diaphragms were originally oiled with the usual diaphragm mixture—viz., 2 parts sperm oil, 1 part rape seed oil, and 1 part neatsfoot oil. But a test is now being made of a lot of new meters, the diaphragms of which were treated with no other oil than the neutral oil. These meters have been in service so short a time that no examination has been made of them.

Meters which have been oiled must be kept right side up, and must not be handled in any other than an upright position, or nearly so. To avoid up-ending the meter when removing the condensation from the inlet and outlet pipes of the meter, a syringe or suction pump is used.

We find that the average cost of oiling meters of all sizes is about 5¼ c. per meter, including labour, supervision, and material. The oil itself costs an average of about 2½ c. per meter.

METROPOLIS WATER (CHARGES) ACT, 1907.

By George Kebbell.

This the latest attempt at introducing uniformity in Water Law becomes operative on the 1st of April next. It leaves much to be desired as regards clearness and brevity; while the opportunity of removing or explaining some of the anomalies and ambiguities in the Acts already in force has been lost. Those responsible for the phraseology of the Act seem to have been oblivious to the doubts and difficulties and costly litigation caused by the use of equivocal terms in the old Statutes, and the present, like too many similar enactments, appears to have been passed in the interests of the struggling legal practitioner of the ensuing decade.

Take, for example, section 26. This provides that where a house is let to tenants (*sic*) holding for any period less than a quarter-of-a-year, the owner, instead of the occupier, shall, if the Board so determine, pay the rate. There are in the section words (pure surplusage) introduced, one would think, with a view to obscuring an already indefinite enactment; but these words are omitted here. It occurs to one at once why should a distinction be drawn—as it evidently is drawn—between "tenants" (which should have been a "tenant") and "occupier." It is surely a distinction without a difference; but where the Legislature has chosen to use in one and the same section two different words having to the ordinary mind the same meaning, it is fair to assume that it was intended a distinction should be drawn and some artificial interpretation given to one or other of the words. Literally the occupier need not be the tenant; but such an occupier as is thus inferred could scarcely be liable for the water-rate. Broadly, occupier means tenant and tenant means occupier. The fact that the owner might himself be the occupier never seems to have occurred to the draughtsman.

The words "if the Board so determine" are most delightfully vague, even for a Water Act. It is nowhere stated how, where, or when the Board are to "determine;" and apparently there is no occasion for them to give any notice, either written or verbal, of its determination. In fact, the Board may intimate such determination for the first time by serving a summons upon the owner, not only for the quarter's rate in advance, but also for all the arrears (if any). This is, and well may be, a startling revelation to owners generally; for without doubt the Board will contend that, by the joint operation of the section defining owner and of Fulton's Act, such owner will, "if the Board so determine," become liable for all rates and arrears of rates due on the property he owns—that is, if his tenant happens to hold for one day "less than a quarter-of-a-year," and this no matter what the annual value may be, £20 or £520. Property owners seem, as usual, to have been fast asleep when this section became law.

Doubtless the intention was to exclude from the operation of

this section all houses let to quarterly tenants. But it does not do so as regards two quarters of the year, because although from December 25 to the 25th of March, and from the 29th of September to the 25th of December are both legal quarters, neither is "a quarter-of-a-year." But the operation of the section will be even more astounding, because if the Board seek to literally enforce their rights, they can recover the rate and arrears from the person actually collecting the rent; for, owing to the definition in the new Act, such person is deemed to be the owner. So it is assumed that a clerk sent to obtain a week's rent would incur the liability referred to. Even the office boy sent on such an errand would become the owner, and be liable as such. A manifest injustice to the owner brought about by the section will be that he has no control over his tenant as regards paying the water-rate; and unless he (the owner) protects himself by obtaining from his tenant such water rate in the shape of rent, he (the owner) will find himself running the risk—and a very considerable risk—of having to make good his tenant's default.

The Water Board, in their anxiety to make some one or the other liable for the rate, have forgotten to introduce into the Act a few provisions for their own protection. They have been blind to the fact that in two or three ways their customers might, by acting in concert, practically stop the Board's business for the time being. For example, suppose the whole of their consumers turned passive resisters. The Board would have in some instances the right of suing only, and in others the power to disconnect or sue. If the Board sued every one of their customers, they would probably recover about two-thirds only of their revenue; for, in the present state of things, it is fair to state that 30 per cent. of the population of London is "execution proof," while the costs unrecovered and unrecoverable of suing, together with the necessarily enormous increase in the staff of the Solicitor's Department, would reduce their revenue another 10 or 15 per cent. Added to this, instead of obtaining the rate a quarter in advance, it would be more like twelve months in arrear. As a result, the Board would hardly be able to pay their way. But the worst might happen when they exercised their right to disconnect. They would have to employ battalions of trenchmen at an enormous expense, and every road would be up and impassable for vehicular traffic. Then all the consumer would have to do would be to wait until the road had been opened up and the main exposed at the spot where the communication pipe was connected, and the minute before the act of disconnection could take place tender the man with the pickaxe a quarter's rate in advance, ignoring any arrears, and the Board's servant would be bound to leave the house in supply, otherwise the Board would be liable to the heavy penalties imposed by the Act of 1847.

The Board would thus have to bear the costs of opening up over the main, relaying, and repacking the earth, together with the fee payable to the parish authorities; and this expense incurred by them would, in many instances, come to about 200 or 300 per cent. in excess of the rate, payment of which they were endeavouring to enforce by cutting off. This position of the Board will be understood when it is explained that the Statutes and regulations give the Board no power to recover the costs of disconnecting or re-connecting unless they have actually and lawfully cut off. And, of course, while this state of things continued, the collectors would be doing nothing, and the staff generally would be idle, but drawing their salaries all the same. A course like this, universally taken and without provocation, would be malicious; but then it must be remembered it might be adopted in a spirit of retaliation should the Board attempt to unduly stretch their almost unlimited powers of recovery against owners and persons defined as owners.

VENTILATION OF PHOTOMETER-ROOMS.

The American Gas Institute Report.

In previous issues of the "JOURNAL" reference has been made to the report presented at the last meeting of the American Gas Institute by the Committee appointed to consider "Methods of Taking the Candle Power of Gas." It was accompanied, as mentioned, by several appendices, one of which contained some observations on the ventilation of the photometer-room.

The following is the computation of the normal vitiation of the air in a room when two adults, one 5-feet gas-flame and one 10-candle pentane flame are present. An adult averages twenty respirations per minute, inhaling some 30 cubic inches of air each time; thus, $20 \times 30 \times 60 \div 1728 = 21$ cubic feet per hour of air exhaled. This air contains 4·3 per cent. of carbonic acid; therefore, $0{\cdot}043 \times 21 = 0{\cdot}903$ cubic foot of carbonic acid per hour. The average of several authorities gives 0·71 cubic foot of carbonic acid per hour and 0·091 lb. of water vapour per hour as the product from one person. By figuring the products of combustion from 5 cubic feet of illuminating gas of average quality as shown by analysis, the carbonic acid yield would be 4·4 cubic feet and the water vapour yield 5·1 cubic feet. Assuming the use of the pentane standard, in each hour there is consumed one-sixth of a pint of liquid pentane, which vaporizes into 0·571 cubic foot. Upon combustion, this produces 2·87 cubic feet of carbonic acid and 3·43 cubic feet of water vapour.

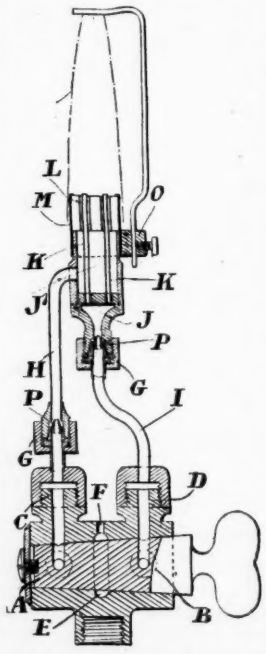
Hence we have as products of combustion from the two flames and the two persons per hour—

	Carbonic Acid. Cubic Feet.		Water Vapour. Cubic Feet.
Two persons	1·50	..	4·00
5 cubic feet of gas	4·40	..	5·10
0·571 cubic foot of pentane vapour .	2·87	..	3·43
Total	8·77	..	12·53

The purpose of ventilation in this case is to maintain the atmosphere in the photometer-room of such purity that there will be present not more than 6 parts of carbonic acid in 10,000 parts. The greatest factor in the vitiation of flames is the water vapour content of the air; and it would seem that our aim in ventilation should be to keep down excess of this. It is found, however, that a computation on the basis of keeping down the carbonic acid content is large enough to include the water vapour removal as well. A total of 8·77 cubic feet of carbonic acid is produced per hour. This is equivalent to that produced by $8{\cdot}77 \div 0{\cdot}71 = 12{\cdot}3$ persons. Kent gives 3000 cubic feet of external air per hour per person as necessary to maintain a purity of 6 parts of carbonic acid to 10,000 parts. Hence it is necessary to provide $12{\cdot}3 \times 3000 = 36{,}900$ cubic feet of external air per hour for the room mentioned above.

HIGH-POWER LIGHTING BY GAS AND OXYGEN.

There is being tried in Paris at the present time, in some of the public lamps in the Avenue Victoria and the Place de l'Hôtel de Ville, a system of high-power lighting by means of a mixture of coal gas and oxygen, with which the Société pour l'Utilisation de l'Air et de ses Dérivés made so effective a display at the recent Automobile Exhibition; their stand ranking, with one lighted by compressed gas, among those which were the most brilliantly illuminated. The Society are working in conjunction with M. Necker, the inventor of the improved incandescent burner associated with his name. In carrying out the system under notice, in an appropriate burner (a variant of the Necker) ordinary coal gas is utilized; but as a supporter of combustion, in addition to the surrounding atmospheric air, oxygen, either pure or in combination with air, is employed. Preferably almost pure oxygen is used; but the yield will, of course, vary with the extent to which air is added. The arrangement of burner shown in the illustration, and which, with the accompanying particulars, has been reproduced from the "Journal de l'Eclairage au Gaz," has been devised with the view of ensuring a small consumption of gas, and particularly of oxygen, and at the same time avoiding deposits of carbon which form so easily in appliances of this nature.



In order to ensure the simultaneous opening and closing of the two currents of gas, the burner is furnished with a tap having two inlets, as shown at A B, but only a single tap. This is pierced with channels, corresponding to the gas-inlets, in such a way that in the opened position the gases flow by the channels C D. In order to prevent the gases passing from one channel to the other, as the result of escapes, there is provided an outlet E, which communicates with the air by means of the orifice F. The burner proper is connected with the channels C D by means of pipes H I and the junction-pieces G. It is arranged to distribute oxygen in the form of separate jets at the base of the flame, or, better still, of a series of small flames, of combustible gas. The oxygen, conveyed by the pipe I, enters the chamber J, and thence flows by the pipes K up to the partition L. The combustible gas, conveyed by the tube H, enters the chamber J^1 at the point shown. The gas may be ignited at the upper part of the mantle-holder M, which forms a covering to the chamber J^1. This arrangement is, however, suitable only for very small burners. The mantle is carried by a projecting piece, fitted with a screw O, fixed on the mantle-holder, and is held in position by an ordinary rod. The quantity of the two gases is regulated by the device shown at P, or in any suitable manner.

In practice, the arrangement of apparatus adopted by the above-named Society comprises a small separate station from which oxygen is furnished to all the burners by means of pipes of small diameter. It is consequently necessary to lay down a double set, one for the coal gas and the other for the oxygen. In private installations, the inconvenience attending this duplication is got rid of to a considerable extent by the small size of the piping required for the oxygen, which allows of the utilization of lead pipes which

can be easily laid. The oxygen is furnished from a bottle of suitable capacity, and as stored it is under a pressure of 150 kilos. (330 lbs.). But when required for use, a reducing-valve brings it down to 2 kilos. (4·4 lbs.), and a regulator lowers it still further to 150 mm. (6 inches) of water, at which pressure it reaches the burner.

It is claimed for this system of lighting that 1 carcel-hour is obtained with the consumption of 3 litres of gas and 2 litres of oxygen, in all 5 litres, or 0·177 cubic foot—in round numbers. But apart from these economic advantages, there is the facility of obtaining without difficulty light centres of great power. In fact, the temperature of the flame is stated to be so high that an ordinary incandescent mantle will give the light of about 300 candles. With regard to the resisting capacity of the mantles, this can be ensured by employing only those of the best quality. There remains the question of cost. An estimate may be formed as to this by reckoning the price of oxygen at about twice that of coal gas. As a carcel-hour is said to be obtained by the use of 3 litres of gas to 2 litres of oxygen, it suffices to just double the quantity of the latter to arrive at the consumption in litres of ordinary gas.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to the Tradeston Gas-Works.

On Saturday afternoon, the members of the Western District Section of the Scottish Junior Gas Association paid a visit to the Tradeston Gas-Works of the Corporation of Glasgow. There was a gratifying attendance of about seventy members. A printed description of the works which was handed to each visitor furnished the following information with regard to them.

The works cover an area of about 15½ acres, and are divided by the main line of the Caledonian Railway. The annual make of gas in 1888 was about 750 million cubic feet, while last year it exceeded 2017 million feet. The works are capable at present of producing 9½ million cubic feet of gas per day. The storage capacity of the four holders is 7,350,000 cubic feet. The total number of retorts is 1152; the maximum make of gas in 24 hours, 8,854,000 cubic feet; and the maximum output, 9,502,000 cubic feet. The works were originally built in 1838; and in 1869 the manufacturing capacity was 1½ million cubic feet per day. In 1888 the production was increased to 4½ millions. In that year the reconstruction of the works was commenced, involving the acquisition of additional land and the closing of public roads and streets; the ground being utilized for railways, sidings, and buildings, and forming railway connections with the necessary under-road and over-line bridges for railways, and carrying pipes and foot passengers. The reconstruction also meant the demolition of antiquated retort-houses, with their chimneys, &c., coal-stores, and plant. A gasholder, 100 feet in diameter, was removed, and the tank utilized for storing tar and ammoniacal liquor. Another gasholder had to be disposed of; the tank being afterwards filled up. One set of exhausters and a station meter were transferred to new positions in the reconstructed works.

The retort-house and coal-store form a block measuring 301 feet long and 322 feet wide, inside the walls, and are covered by four iron roof spans supported on cast-iron columns, lattice girders, and side walls. The walls are 35 feet high from the ground level. There are four retort-benches, set parallel to each other, each consisting of 16 through ovens, having chimneys 100 feet high in the centre of the benches. Three benches have settings of eight and the other has settings of twelve retorts. These are all the same size—viz., 21 in. by 15 in., ⌂ shaped, and 9 feet long. They are heated on the regenerator system by external and internal gas-producers. Retort-house governors are in course of being fitted to the mains in two of the houses. Part of the coke withdrawn from the retorts is required for heating them; but the bulk of it is removed to the coke-yard in iron side-tipping waggons drawn by small locomotives running on rails laid with a 2-feet gauge. A complete installation of Arrol-Foulis charging and drawing machinery, worked by hydraulic pressure of 430 lbs. per square inch, is fitted throughout. In the coal-store, which has a capacity of upwards of 14,000 tons, there are three lines of elevated railway with cross-overs, and three hydraulic capstans, and nine twin-ram tipping-machines. Here all the coal waggons are manipulated and emptied into the hoppers placed opposite the coal-breakers. Bucket elevators raise the broken coal to the storage hoppers, from which the charging-machines draw their supplies as required.

The hydraulic pumping-engines comprise two horizontal direct-acting duplex steam-engines, with hydraulic pumps, and one large horizontal steam-engine, with the pumps worked from the extension of the piston-rods. The discharge pipes are connected to an accumulator, which is loaded to give the desired pressure. The condensers here used are of the atmospheric type, formed of cast-iron pipes arranged vertically. There are twelve sections of 9-inch and eight sections of 12-inch pipes. Gas enters the condensers at about 140° Fahr., and leaves at about 60° Fahr. There are four sets of two exhausters, each set being driven by a vertical steam-engine placed between them. Each exhauster is capable of passing 100,000 cubic feet of gas per hour. There are four scrubbers—two vertical and two horizontal—each driven by a separate steam-engine. In the vertical machines, devices containing bundles of thin boards are constantly being raised and lowered in chambers filled with water or weak ammoniacal liquor. In the horizontal machines, bundles of iron plates are fixed to discs on a shaft, which revolves at a slow speed, and clean water passes from the outlet end through each chamber, meeting the gas coming forward in the opposite direction. The purifier-shed is 350 feet long and 100 feet wide, in two spans, and contains four sets of purifiers, each consisting of four cast-iron boxes, 35 feet square. There is a line of railway along each side for the lime-waggons. Lime is the purifying agent, and it is spread evenly on the two tiers of wood grids placed in each box. The lime is burnt in lime-kilns within the works.

The station-meter house measures 107 feet long and 34 feet wide, and contains four meters for measuring the quantity of gas made. Each meter is capable of passing 120,000 cubic feet of gas per hour. Within the house are placed the air-vessels, registers, and gauges in connection with the governors. The last-named appliances are placed underground, and connected to each trunk main at the most convenient position. There are seven mains leaving the works, varying in size from 18 to 30 inches diameter. As already mentioned, there are four holders, of a combined capacity of 7,350,000 cubic feet. The largest is a three-lift one, erected in 1896. It has a capacity of 4¾ million cubic feet. The tank, which is of brick with a backing of clay puddle, is 220 feet diameter and 46 feet deep; and the height of the standards from the coping of the tank is 138 feet. After the coke is quenched in the yard, it is lifted by means of grabs worked by travelling cranes on the gantries, and is either loaded into waggons or carts direct, stored, or placed in the riddling or screening machines, where it is sorted and filled into carts or waggons for customers. The erection of improved coke-handling plant is in contemplation. There are three locomotives of the ordinary 4 ft. 8½ in. gauge, and six of 2-feet gauge, for dealing with the traffic within the works, in which upwards of 217,000 tons of coal were carbonized last year. The number of men employed varies from about 500 in summer to 690 in winter. A complete range of stables and workshops forms part of the works. The gas is tested by means of Carpenter's No. 2 "Metropolitan" argand burner and Harcourt's 10-candle pentane lamp.

The company were first conducted to the coal-testing house, where very complete plant is in use.

Mr. ALEX. SMITH, the Manager of the works, here extended a hearty welcome to the Association. Having expressed regret that the Engineer (Mr. A. Wilson) was unfortunately unable to be present, on account of a cold, he said the Corporation had about thirty varieties of coal coming into the works, and it was tested in plant which dealt with one-thirtieth of a ton. They kept records of the gas and coke yielded, as well of the ash and residual products.

Five parties were then made up, led by Mr. Smith, Mr. W. Glen (foreman), Mr. C. Houston (fitter), Mr. A. M'Donald (chemist), and Mr. C. Macfarlane (chemist at Provan, and formerly of Tradeston). A leisurely walk through the works, occupying two hours, followed, in the course of which all the processes in use were inspected, and the working of the machinery explained and practically illustrated.

At the conclusion of the visit, Mr. Smith entertained the party at tea in the Y.M.C.A. rooms at Eglinton Toll.

The PRESIDENT (Mr. W. Wilson, of Falkirk) remarked that the least the company could do was to accord a hearty vote of thanks to Mr. Smith for his hospitality, and also to the Corporation of Glasgow for the privilege accorded to the members of going through the Tradeston works. There was about the largest turn-out they ever had at a visit, which showed that they were fully alive to the privilege which had been extended to them; and he thought they had all greatly benefited by what they had seen. The works were certainly not the most modern; but perhaps there was as much to be learnt in moderately ancient as there was in very new works. They were all sorry Mr. Wilson, the Chief Engineer, could not be with them, because he took such a fatherly interest in the Association. In the vote of thanks, he would like to include the members of the staff, who had so ably explained every detail in connection with the works.

Mr. SMITH said he considered the members had paid him a great honour in coming to see the Tradeston works. It was true they were not the most modern—Provan being the premier works just now; but, as they had been reconstructed not very many years ago, and as he took a great interest in Tradeston, having been there from the time of the reconstruction, he was pleased to see the members there. As the works were not originally intended for machinery, the visitors would have a pretty good idea of what had been done in putting it in. No works were built now which were not erected with a view to the introduction of machinery, either for inclined or horizontal retorts—and probably for vertical retorts in the near future. This might be the case in their own works. He did not think the time was far distant when they might expect to have a sample of vertical retorts working in Glasgow; and he considered there was a great future for them. He would be very pleased to see the members on some future occasion, when there might be something new to show them; but, whether or not there was anything, he would be glad to see them again.

The company then dispersed.

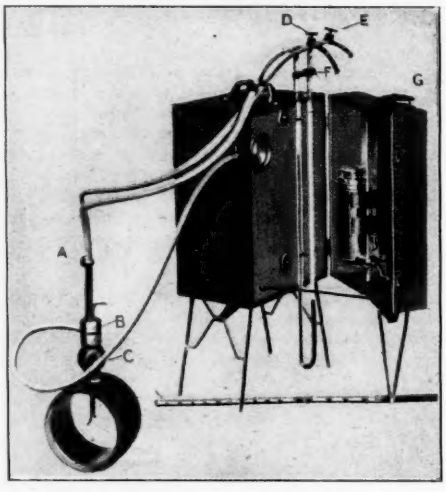
RECORDING THE LEAKAGE OF WATER.

The "Pitometer."

In the "JOURNAL" for the 7th inst. (p. 28), brief reference was made to a paper read before the Mechanical and Engineering Section of the Franklin Institute, by Mr. EDWARD S. COLE, of New York, on the subject of the "Pitometer"—an instrument specially adapted for measuring and locating leakage of water from mains, imperfect pumps, and other sources of waste. The paper was given in the "Journal of the Institute" for the past month; and from it we make the following extracts.

Modern methods of economy have made their way into our conservative city water departments, and a desire to know what becomes of a costly water supply in its dark and hidden path from source to consumer has been aroused, so that a full accounting is now expected of the distribution engineer as well as of the official who collects the water-rents. In attempting to account for his product, the water-works manager has always been at a disadvantage, because several feet of earth and costly paving cover the heavy iron pipes in which the water is distributed.

Now, however, by using the portable pitometer measurements may be made at any point on a distributing system by simply making a tap and placing a 1-inch service cock in the main; and such measurements may be repeated as often as desired at any time, by day or night, in winter or summer.

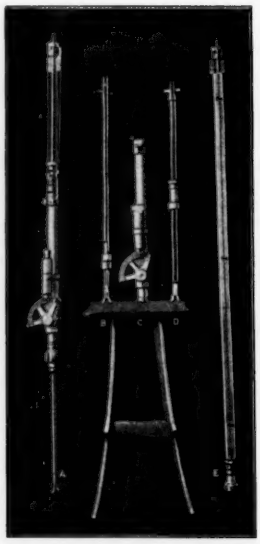


The Photo-Pitometer.

The development of the pitometer was taken up by the writer in 1895, under the direction of John A. Cole, in the hope of making use of the Pitot tube as a waste-meter at Terre Haute, Indiana, where an extensive examination of water consumption was being carried on. After much costly experimenting, suggested by a crude sketch contained in Professor R. C. Carpenter's "Experimental Engineering," the instrument proved to be accurate and efficient; and since then the addition of a photo-recorder has been adopted on important tests in many of the largest cities. Its fundamental principle was discovered by the French engineer, Pitot, about the year 1732, and later improved by D'Arcy for use in open channels; but the application to water-mains under pressure has been developed only during recent years. The photo-recording pitometer may, however, be classed among our most useful and accurate engineering instruments.

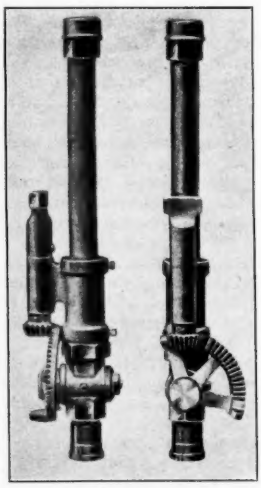
The pitometer is primarily a rate-meter, depending as it does upon the velocity of the water within the main. It consists of two small tubes bent at their lower ends, with carefully formed orifices, held in a suitable cap, which screws upon a standard 1-inch cock, through which the tubes may be readily introduced into any main, and as easily withdrawn. The rod meter is the most recent development of the instrument, by which the slender tubes are enclosed in an oval sheath which enables the meter to be introduced into the main from the surface of a city street through a "street connection" which is permanently set up on the main. Wherever street connections are placed, they are always available for use; and through them, by means of the portable rod meter, the flow in the main can always be ascertained.

Heavy cloth insertion rubber tubing connects the orifice tubes with a long glass manometer or U-tube; and blow-off cocks are provided to remove air from the instrument. The U-tube is half filled with a mixture of carbon tetrachloride and gasoline, having a specific gravity of 1·25, and when in use the water from the pipe fills all the remaining space in the U-tube and connections. The deflection, by virtue of the differential action of the water and the slightly heavier insoluble liquid, is just four times that due to the actual difference of water-head on the orifices produced by the flowing stream. The current impinges directly on one orifice, but the other is turned down stream, and gives something less than



The "Rod Meter" and "Street Connection."

the static head within the main—thus increasing the difference of pressure produced. This difference is then multiplied in the U-tube; the result being that even a low velocity within the pipe produces a readable deflection. Without this effect, the simple Pitot tube would hardly indicate a velocity of less than 1 foot per second; while the pitometer is reliable at velocities as low as 6 inches per second. At ordinary velocities, the U-tube deflections may run up to 24 inches, and therefore need not be read with any great nicety.



The "Street Connection."

The photo-recorder consists of a portable box in which a drum carrying "Velox" or "Azo" paper revolves before a fine vertical slit just in front of which is locked one leg of the U-tube in such a position that the rays of light from an oil-lamp will be partly intercepted on their way through the coloured liquid in the lower half on the manometer. As the liquid rises and falls with the velocity in the pipe, it will record on the sensitized paper a line or band of shade of which the ordinates vary according to the well-known formula—

$$V = c\sqrt{2gh},$$

in which h is one-quarter of the U-tube deflection in feet, or half of the recorded ordinate on the paper. A 12-hour photographic record is 18 inches long and 10 inches high. Autographic horizontal lines are formed by notches in the drum slit, spaced so as to correct for the angularity of the light and enable the true deflection to be readily taken from the diagram at any point.

An autographic record or variation in static pressure is superimposed upon the flow diagram by means of a suitably connected gauge and a movable finger, which intercepts the light passing through the U-tube and slot. This pressure record is of great value in the interpretation of any sudden change in the rate of flow, for by its aid we may decide whether the observed variation is caused by a corresponding difference in pump pressure, as in "direct systems," or by the change in rate of draught within the district under investigation. Thus the detection of waste is facilitated. The accuracy of the pitometer has been established by

many weir tests, and also by calibration in open channels, where the absolute velocities indicated by the instrument are compared with float measurements.

Such being the nature and form of the instrument itself, it remains to consider its practical utility and the several ways in which it has been applied to the problems which are presented by a modern water-works plant in a rapidly growing city. These naturally fall under two leading lines of investigation, each of which is of incalculable commercial importance, and in each of which the pitometer affords unique and very economical methods. These are, first, the survey of underground pipe systems for the purpose of locating all uses and waste of water, incidentally ascertaining the condition of water-mains, stop-valves, and house services; and, secondly, the supervision of pumps by means of which any loss of action or imperfection in work is revealed.

In a water-waste investigation, a city is divided into large districts, closing all the main gates but one, placing a recording pitometer on the inlet to the district, and keeping a record of the inflow. This total use in connection with the district population and the amount registered by the private meters will give a good idea of the wastefulness of the section, taken as a whole—the rate of night use being most significant. In case the district shows a reasonable rate, it may be passed by, thereby saving the expense and trouble of house-to-house inspection. If, on the other hand, an excessive consumption *per capita* is indicated, the next step is to analyze the supply by streets—using the pitometer to record the "drop" in flow as valves are closed one after another. All streets do not waste water at the same rate per tap; and for this reason it is easier to pick out an unusual flow. When the night waste has been localized within a few blocks, this smaller section is enclosed by itself, and supplied through its own waste-meter. Then, if necessary, the curb-cocks are closed one after another at night, the waste-meter at the same time continuously recording the rate of flow; so that when a house is reached which has a leaky service-pipe or fixture, the pitometer on the main, on closing the main cock, will record a "drop," which is the rate of waste. In this way a record showing the condition of every house on the street is obtained, and waste is located, which can further be defined by house-to-house inspections. The waste-meter record not only locates the loss on certain premises, but measures it.

This method by the use of the pitometer in the development of the long-established Deacon system, while it is still very much depended upon in England, has not proved popular in America, though for several years it was used in Boston with success. Every large city should organize its own permanent department for the systematic detection of waste according to some such plan as has been outlined, and in Washington (D.C.), Pittsburg, and Chicago this has been done. The work calls for the intelligent and skilful supervision of an engineer, and must be persistently followed up, for years if need be, to secure the final results. The time required to traverse a square mile depends on the number of waste-meters employed, and upon the physical condition of the pipe system. Several districts may be inspected at one time under the direction of one competent head. Experience has amply proved the value of such work, for its results are felt at once, and the cost may be repaid out of savings as the investigation proceeds.

In the wide range of water supply to American cities, the reported figures are liable to be in error from an unsuspected slippage in the pumps. One of the first discoveries to the credit of the pitometer was in a city of about 125,000 population, which had been reporting 33 per cent. more water than was actually leaving the pumps; and since that illuminating experience, pitometer tests show that leaky pumps are the rule rather than the exception, with losses from 25 to 50 per cent. by no means unheard of, even in engines of the highest type and largest size. A wide variation in *per capita* consumption is due to trade use, which will vary as cities are more or less devoted to manufacture. Public uses, while but a comparatively small part of the total consumption, include the supply to public buildings, schools, and hospitals. Street sprinkling, sewer flushing, and fire extinguishing call for attention when reducing the supply to a *per capita* standard.

Domestic consumption varies according to the habits of the people; and upon this point we are able to form a fairly well-based opinion as to what constitutes a reasonable allowance. For example, in Worcester (Mass.), the total domestic use *per capita*, as shown by meter, is only 16·8 gallons—varying from 12 gallons in the cheaper houses to 23 gallons in the best residence streets. We should remember that such figures are for actual house requirements by meter measurements, and take no account of waste in service-pipes beyond the meter or in mains.

An examination of the hourly records of pumpage in cities is convincing as to the existence of waste. The notable feature of such records is that the rate is usually high, even at the dead of night. While we cannot judge of the relative wastefulness in various cities by a comparison of the *per capita* consumption, we find in reviewing statistics that the use of meters is attended with a reduction of waste. The effect of placing meters on about 40 per cent. of the consumers, including the largest, seems to indicate that a further addition of meters does not yield a proportionate saving. Evidently losses beyond the reach of house meters come in here, and point to the need of special waste investigation. The introduction of a meter system should, therefore, be supplemented by tests for the restriction of losses in mains and services.

Leaks beyond the reach of the meter in the house are undoubtedly larger than supposed, as evidenced by recent tests and meter comparisons. In a number of cities having practically every tap metered, there is a discrepancy of from 30 to 50 per cent. between the total pumpage and the total meter registration. This unmistakable loss often remains after allowing for unmetered public uses, fires, and for slip pumps. Leaky, broken, and abandoned service-pipes are responsible for much waste, which, because of a porous soil, may not give warning at the surface. Electrolysis has often been the cause of the deterioration of city mains and services, and should be carefully studied.

All the reported pumpage does not reach the main because of slip and station use at the pumps. It is customary to make only very small correction for this loss, and, in fact, the statistics of most cities are based upon the full amount of water displaced by the pump plungers; the almost universal method being to multiply the recorded strokes of each engine by the theoretical number of gallons displaced per stroke. The only merit of this method lies in its simplicity. That it is liable to gross error has been found on many occasions when the actual discharge from a pump has been measured and compared with the counter record. This loss should always be determined and deducted from the reported supply to a city; for evidently slip at the pumps is not only misleading, but requires the same engine capacity, steam, and fuel as though the full plunger displacement were discharged into the mains.

At the close of the paper, the author was asked to explain how he ensured accuracy by his method of gauging the flow in a pipe; and he replied as follows: In the first place, the absolute velocity at the orifices, as indicated by the corresponding U-tube deflection, has been carefully calibrated in a long, open trough by means of loaded floats made to run over a measured course. These floats were timed by electrical contact made automatically at each end of the measured course and recorded by chronograph. In our experiments the trough was of wrought iron in the form of an open semicircular conduit 40 feet long. The measured course was laid out some distance below the head of the trough at a point where the depth of flow seemed to be uniform. The whole affair was hung from a supporting I beam, so as to be adjustable to various slopes. Our pitometers were introduced through 1-inch taps placed vertically beneath the trough, the orifices rising to within half-an-inch of the water surface.

A direct comparison between velocity as determined by the floats and chronograph was thus made with the corresponding U-tube deflection; and the plotting of a large number of such comparison tests produced a calibration curve which, when compared with the theoretical flow, gave us the value of c equal to 0·80 in our formula:—

$$V = c\sqrt{2gh}.$$

Thus when gauging the flow in a pipe, we are able to plot the actual velocity at various points in the cross-section by "traversing" two diameters inch by inch from side to side. The orifices ought to remain at each point long enough to give several readings of velocity, the mean of which is plotted, so that on completing the traverse we have a curve representing the distribution of velocity from side to side in the pipe. Where, as is often the case, the rate of flow is not uniform, it is necessary to return frequently to the centre of the pipe to guard against error through a change of rate. It is often convenient to use two instruments, allowing one to remain at the centre, while the other is moved from point to point across the pipe. Observations are, of course, only taken when the centre velocity is normal.

The next step is to divide the cross section of the pipe into a series of rings and approximately equal area, multiplying the area of each by the average velocity for the ring as given at four points 90° apart by the two traverse curves. The total of the discharges found for these rings is, of course, the total flow in the pipe, which divided by the whole area of the pipe gives the mean velocity. This, in turn, when divided by the maximum velocity observed at or near the centre of the pipe, determines what we call the "pipe coefficient," which commonly varies, according to the condition and age of the pipe, from 0·70 to 0·90. This ratio of mean to centre velocity is the characteristic of each pipe location where a gauging is sought, and it must first be carefully obtained. When once determined, however, it holds good at all velocities at that particular location; and it is only necessary to leave the pitometer orifices at the point of maximum velocity in order to record the mean flow, which, for practical purposes, will always be a fixed percentage of the maximum. A scale is prepared for each pipe, based upon the computed coefficient. By means of this scale, the rate of discharge, in million gallons per 24 hours for each inch or fraction of an inch of U-tube deflection, may be read off from the record.

The final test of the accuracy of a pitometer gauging rests upon the comparison of flow, as determined by the above method, with that given by a standard weir or measuring-tank. A number of tests have been made with weir comparisons in pipes of several sizes up to 72 inches, and notably at the laboratory of the Worcester Polytechnic Institute, where a very perfect weir receives the flow of a 30-inch pipe. We feel justified by our experience in claiming an accuracy of from 2 to 3 per cent. in fairly clean pipes when the pitometer is carefully handled.

No attempt is made to accurately measure the flow by our method in a main which is found to be badly corroded. However, the very process of traversing the main as described will reveal

the presence of tuberculation, for its effect is to abnormally diminish the velocity near the side of the pipe, and thereby reduce the velocity ratio. The net area may often be obtained by the introduction of a caliper which enters the main in the same manner as the pitometer itself, and by touching the top and bottom of the pipe will give a fair idea of the net diameter at that point. It is usually quite easy to find a suitable point for gauging the flow to any given district through a pipe comparatively free from corrosion. Ample warning is given by the result of the preliminary traverse, so that an error due to tuberculation is unnecessary.

REGISTER OF PATENTS.

Manufacture of Producer Gas.

CROSSLEY, W. J., and RIGBY, T., of Manchester.

No. 28,181; Dec. 11, 1906.

This invention has for its object the manufacture of producer gas free from tar from fuels containing tarry matter—such as bituminous coal, lignite, peat, wood, &c. It is mainly intended for the gasification of bituminous coals, most of which cake hard together during the period the volatile matter is being expelled from them; and consequently when used in an ordinary gas-producer these caking coals are difficult to work, as the caked fuel causes "scaffolding," and the formation of holes and cavities in the fuel bed.

According to this invention, the fuel is spread in a layer on a grate or other suitable support, and is in the first place partially burned and subjected to heat in such a manner that the volatile matter is expelled, and the tarry matters contained in it consumed—the resulting heat causing the volatile matter to be expelled from the fresh fuel as it is fed in. The resultant from this first process consists mainly of carbon and ash; and when the fuel so treated is bituminous coal, the product will be "coke" free from tar. The resultant coke is passed into a gas-producer arranged to receive it; and the products of the combustion of the volatile matter and primary air will usually be passed, either alone or in conjunction with an additional supply of air, through the hot fuel in the gas-producer. In the result, the gas from the producer will be free from tar, and most of the heat of the volatile matter will be recovered and converted into producer gas.

Producer-Gas Generators.

CROSSLEY, W. J., and RIGBY, T., of Manchester.

No. 28,834; Dec. 18, 1906.

This invention relates particularly to gas-producers in which the fuel is in the first place partially burned and subjected to heat in such a manner that the volatile matter is expelled and the tarry matters contained in it consumed; the coke resulting from the primary combustion being then passed into the producer and consumed by the products of the primary combustion, either alone or with a secondary air supply or steam or with both. In such a gas-producer, the patentees now propose to employ an inclined fire-grate, and, if necessary, an extension of it as the primary combustion device, and burn the fuel preferably in a thin, even layer thereon. They so arrange this grate that the fuel will gradually and easily slip down, and descend the sloping grate into the producer below—the inclination of the descent being so adjusted or arranged that the volatile elements of the fuel will have been expelled from the resultant coke before the latter reaches the producer.

Analyzing Gases.

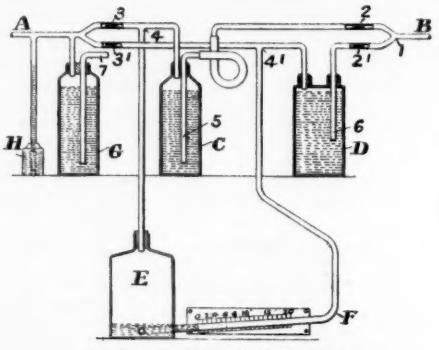
WISE, W. L.; a communication from the JONES-JULIA MANUFACTURING COMPANY, of New York.

No. 1562; Jan. 21, 1907.

This invention relates to apparatus for analyzing a continuous stream of gas for the purpose of ascertaining the percentage of a constituent thereof.

It has been proposed heretofore, the patentees point out, to ascertain the percentage of constituent by feeding the gas continuously in limited amount through an absorbent, and determining the value of the constituent by the change of tension produced by the removal of such constituent by the absorbent as indicated upon a suitable manometer. But this method is said to be open to the objection that a change in the pressure or tension at which the gas is fed to the instrument will cause a fluctuation in the tension of the gas in the space with which the manometer is connected, and will therefore affect the reading of the instrument; and hence with this method the results will be only accurate for a given pressure for which the apparatus has been adjusted, and which has been kept stationary. The accuracy of the reading will likewise, for a similar reason, be affected by changes at the vacuum or suction end of the system.

The object of the present invention is to overcome this objection by feeding the gas in two streams, absorbing an absorbable constituent thereof from one of the streams passing in limited amount through the absorbent and then through a chamber in which the tension may be observed, and utilizing the difference between the changed tension or pressure thus produced and the tension or pressure of the other stream as an indication of the percentage of such constituent. The limited flow of gas in the chamber or chambers whose difference of pressure is measured, is preferably secured by connecting them with the pressure and exhaust pipes through minute inlets and outlets as at present. A manometer is connected to the two streams, so as to give readings which measure the distance of tension or pressure between them due to the removal of a constituent of the gas in one of the streams by the action of the absorbent. To balance the resistance to the passage of the gas through the absorbent for one of the streams, it is preferable to employ a non-absorbing solution in the path of the other stream; and to secure a reading due to the difference of tension in the streams of gas, the two sides of the manometer may be connected respectively to the chambers or spaces through which the streams of gas flow in limited amount. Under this condition, the manometer will respond properly to differences of tension between the two streams; but it will be affected alike on its two sides by any changes in the difference of tension between the inlet or supply and the exhaust or suction ends of the stream respectively. The readings will thus not be disturbed.



An American Gas Analysis Plant.

In the illustrations, B is the supply end of the system through which gas (say, flue gas) is fed after passing any necessary filter or condenser. A is the suction or exhaust end of the system; the flow of gas being due to the difference in tension or pressure between B and A. At 1 the gas divides into two streams, one of which passes through a minute inlet 2 (comprising, preferably, a tube of very small bore), and escapes through a similar outlet 3 to the suction end A of the system. The other stream passes in a similar manner through a minute inlet and outlet 2^1 and 3^1. In this way a limited amount of gas only can pass, and a certain amount of vacuum will be produced in the chambers or passages located between 2 and 3 and between 2^1 and 3^1. Between 2^1 and 3^1 is the absorption chamber, comprising, for instance, a tank D containing a solution of caustic potash or other absorbent.

At 4^1 (or at any other suitable point where the tension of the gas feeding from B is changed from the normal, owing to the absorption of the constituent carbon dioxide or other gas), a pipe is led to one side of a manometer F. At 4 in the pipe or passage between 2 and 3, connection is made to the other side E of the manometer.

Preferably, there is interposed in the connection from 2 to 3 another tank C containing a non-absorbing solution through which the gas is caused to pass, so that, by regulating the depth of immersion of the tubes 5 and 6, the resistance to the passage of the gas in the two chambers may be adjusted to produce a tension which would be the same if the gas were of such a nature as not to be absorbed or modified in respect to its constituents by passing through either tank D or C. Owing to the system of connections, it is obvious that the changes of tension at 4 and 4^1 will be the same if caused by any changes or difference of tension between B and A.

If, now, gas containing carbon dioxide be passed through the apparatus, it will be absorbed in the potash solution in D, the equilibrium in the manometer will be disturbed, and the liquid in the measuring tube of the manometer connected to F will rise in direct proportion to the amount of gas removed by the solution in D. This reading enables the operator to ascertain the percentage of carbon dioxide as usual.

The manometer shown has a sloping or inclined graduated tube on the side F of very small internal diameter, which, in practice, may be 3 mm. At the other end E, a large tube or bottle is employed; so that practically all the movement due to changes of pressure will be in the small tube. The capillary attraction in the small tube causes its surface to stand at right angles to the bore of the tube, instead of occupying a horizontal plane. The apparatus may be arranged to indicate 1 per cent. for each one-fiftieth of an inch of vertical rise, by inclining the small tube at such an angle that this movement is multiplied by ten. Thus, if the tube rises 1 in 10, the liquid, in rising one-fiftieth, will move one-fifth inch in the bore of the tube for each 1 per cent.

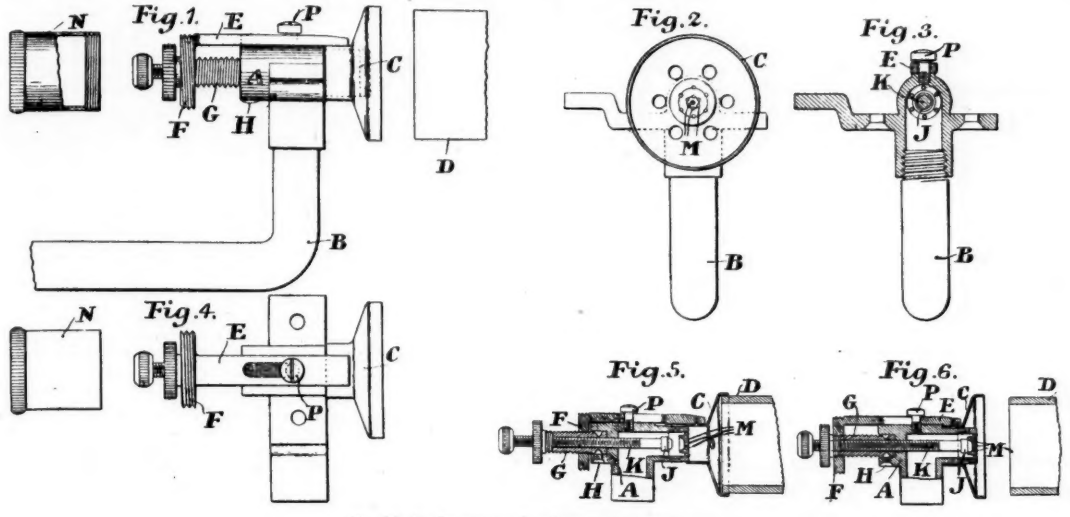
To bring the apparatus to scale or to register correctly, means are provided for regulating the suction applied at A. A device suitable for this purpose comprises a liquid-containing tank G connected to the suction pipe A and having a regulable gas inlet tube 7, whose immersion may be altered to vary the rate of inflow of air or gas into the pipe A at or near where it is attached to the outlet 3 3^1. By depressing the tube 7, the suction or vacuum in A can be made stronger; while by raising it the vacuum will be decreased owing to the admission of air or gas through G. A manometer H, filled with glycerine, may be used to indicate the degree of suction or vacuum.

Regulating the Supply of Gas and Air to Atmospheric Burners.

PARKINSON AND W. & B. COWAN, LIMITED, and CHESHIRE, W., of Birmingham.

No. 1990; Jan. 26, 1907.

This invention has more particular reference to that type of regulating injector or fitting in which both the gas-inlet or admission valve and the air regulator used in connection with gas-fires and the like, can be operated either independently or simultaneously and collectively; and the principal object aimed at is to provide such a construction of regulator fitting that the separate gas and air regulators are arranged in relation to one another so as to admit of them being more



Cheshire's Regulator for Atmospheric Burners.

readily actuated simultaneously, and also to more readily admit of the one being actuated without the other.

Fig. 1 represents an elevation of the regulating device with the cover-cap, which protects the regulating screws from inadvertent rotation, detached. Fig. 2 is an end view showing the gas and air inlets. Fig. 3 is a transverse section of the appliance. Fig. 4 represents a top side plan. Fig. 5 is a longitudinal section showing the parts in the positions they assume when only the minimum air supply and the maximum gas supply is being admitted to the burner. Fig. 6 is a similar section, showing the parts in the positions when the maximum air supply and minimum gas supply is being admitted.

The body of the fitting consists of a hollow or tubular part A carried by a bracket or attachment plate and having extending from it a socket or branch wherein the gas-supply pipe B terminates. The air-supply regulator is mounted on the part of the stationary body which is adjacent to the intake end of the burner, and consists of a disc or a flanged circular plate C, pierced with a series of holes of sufficient size to admit the minimum air supply to the burner, and adapted to be made to socket over the intake end D of the burner, or to closely abut against it when set in position for admitting the minimum air supply. It may, however, be so adjusted as to leave an annular space or clearance between its outer edge and the end of the burner, to serve as an additional air-inlet, whose adjusted width determines the quantity of additional air admitted through it.

The air-regulating plate is carried by a short sleeve or ring mounted on, and capable of longitudinal adjustment over, one end of the stationary body part. This sleeve is connected by a bar E running along the outside of the fitting to a circular plate F, which is located at the opposite end of the body—approximately concentric with the axis of it, and adapted to be actuated or influenced by an air-adjusting screw G for the purpose of altering the position of the regulator disc relative to the intake end of the burner.

This screw, which is of comparatively coarse pitch, is confined against longitudinal movement with respect to the stationary body A by means of a set-screw H engaging in an annular groove, and is passed through a wormed axial hole in the plate F; so that when the screw is rotated in one direction or the other by means of a milled head at its outer end, a corresponding advancing or retiring movement is imparted in the air-regulating disc C, and the width of the annular supplementary air-inlet is altered accordingly. Or the disc may be made to abut or socket full-home against the burner, so as to completely close the additional air-inlet.

The means for regulating the gas supply (arranged within the interior of the fixed body A) consists of a valve J, which is operated or adjusted by a second screw K, which preferably has a fine thread so as to provide for a fine or delicate adjustment of its valve, and is directed along a plain axial hole in the air-regulating screw G and passed into the interior of the device through a wormed hole. The screw terminates within the interior in the valve proper J, which is traversed by the rotation of the screw, and is made to open or close certain additional gas-passages formed in the end of the body near the inlet of the burner.

The holes may be arranged in concentric ring-like series, and the outer series are so disposed with respect to the valve that they never close and always provide a clear passage for the minimum quantity of gas; whereas the inner series M of holes are adapted to be opened or closed by the valve J, and so regulate the additional quantity of gas which can pass through it to the burner.

Regulation of Gas-Exhausters, &c.

BLAKELEY, W., of Thornhill Lees, Yorks.

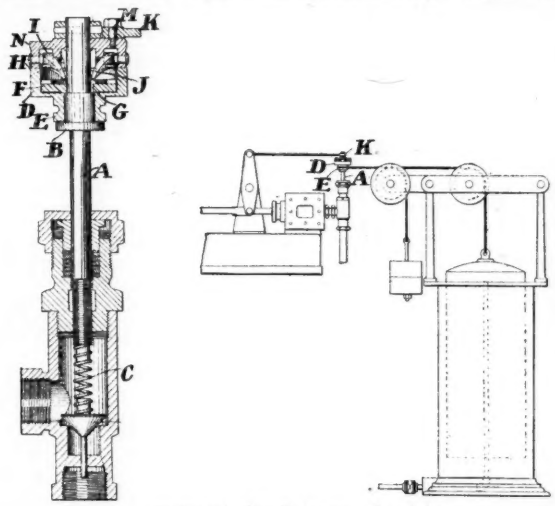
No. 23,475; Oct. 24, 1907.

This invention relates to speed regulators for gas-exhausters, steam-engines, and the like, wherein the admission of the motive fluid is controlled by a valve—the regulator being interposed between the valve and any other governor, in order to render the action of the governor more efficient.

A well-known type of such regulators comprises two pawls receiving regular oscillating motion from any convenient reciprocatory part of the engine—such pawls acting alternately in opposite directions upon a face or crown wheel or upon a ratchet wheel connected by gearing to the valve spindle. The pawls have been normally kept out of engagement with the face or crown wheel by a rotary shield; and various arrangements have been employed to prevent over-running. But according to the present invention, the face or crown wheel is secured directly to the valve spindle, and a cam surface is provided to keep the pawls normally out of action. A portion of the valve spindle is constructed in the form of a spring, so that any slight over-running of the regulator, after the complete closing of the valve, merely results in compression of the spring.

Details are shown of the valve and regulator; also of the regulator arranged in connection with an ordinary hydraulic governor such as is used in connection with gas-exhausters.

A is the valve spindle, on which is formed a collar B. A spring C connects the valve to the spindle. Surrounding the spindle and resting upon the collar is a cup D, the lower part of which may form a grooved pulley E, between which and the collar may be anti-friction balls. Within the cup is a disc F, provided on its upper surface with teeth forming a circular rack or face wheel. The cup can rotate freely about the spindle; but the disc or wheel F is keyed to it at G, or caused to rotate therewith by a pin on the spindle entering a recess in the



Blakeley's Gas-Exhauster Regulators.

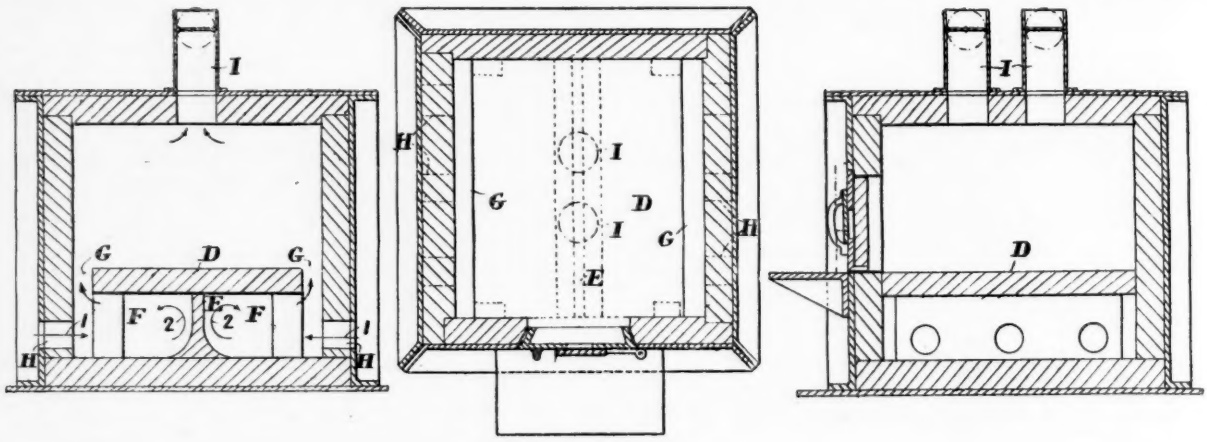
wheel. A portion of the upper edge H of the cup is dished or recessed at the curves or cam surfaces at each end of the recess. Above the wheel F are two pawls I J, adapted to engage the teeth of the wheel F, and continually travel over the wheel in opposite directions under the influence of a crank K, actuated by any convenient reciprocatory part of the engine. The crank in this instance acts upon a pin M in the cover N, in which the two pawls are supported. From the pawls project pins, which travel upon the upper edge of the cup D. The pawls are thus normally kept out of engagement with the teeth of the wheel F; but when the valve requires to be operated and the cup is rotated to a sufficient extent by the action of the governor, the lower portion of the track H comes under one or the other of the pins, and the nose of the pawl connected to that pin being thereby lowered into gear with the teeth of the wheel F, transmits to the wheel, and thereby to the valve spindle, the rotary movement imparted to the pawl by means of the crank. Thus the only work required of the governor is to rotate the cup D, which may be accomplished by means of a cord from the governor passing around the pulley E, or in other convenient manner.

Gas-Heated Furnaces.

ONSLOW, A. W., of the Royal Arsenal, Woolwich.

No. 5342; March 5, 1907.

This invention relates to furnaces adapted to be heated by gas, and chiefly designed for use in case-hardening, tempering, and annealing steel. But it is also applicable for other metallurgical operations; the



Onslow's Gas-Heated Furnace.

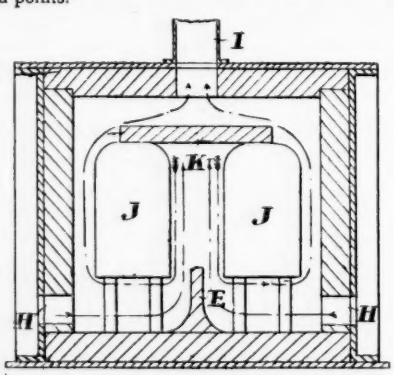
object being "to provide means whereby high temperatures can be obtained in a shorter time than heretofore, and with a smaller consumption of gas."

The table or bed upon which the articles or materials to be treated are placed, is supported upon a baffle or partition extending longitudinally or transversely in such a manner that a cell is formed on either side of the partition or baffle beneath the table or bed. In the walls of the furnace parallel with the baffle or partition, and opposite to the cells, is formed a series of apertures through which the jets of gas are injected, so as to strike the baffle and then to rebound and pass up between the sides of the bed and the walls of the furnace; the jets of flame then passing upward and striking the roof of the furnace, whence they are directed downwards on to the upper side of the bed or table. The gas-burners preferably used are of the type described in patent No. 24064 of 1904, which are designed for use with high-pressure gas.*

In the gas-heated furnace shown, D is the table upon which the materials to be treated are placed, and E is the baffle or partition—represented as extending longitudinally through the furnace chamber so as to form two cells F, one on each side, in communication with the space above the table by means of the lateral passages G. H are inlets formed in two of the opposite walls, and through which the gas-jets are injected in the direction of the arrows 1. The jets strike against the sides of the baffle and whirl round in the direction of the arrows 2, whence they pass out through the lateral passages G into the space above the table, so that they strike the top of the furnace and are deflected downwards on to the articles on the table. The products of combustion finally escape through I.

The nozzles of the burners are arranged opposite to the openings H, through which, however, they do not project, but terminate near the entrances in such a manner that the jets of combined gas and air, which are ignited at the nozzles, will draw through the openings a sufficient further quantity of air to ensure the proper combustion of the gas without reliance being placed upon the presence of air in the furnace for supporting combustion. By proceeding in this way, liability of explosions taking place—"such as frequently occur in furnaces into which gas, mixed with an imperfect supply of air for combustion, is introduced"—is avoided.

In practice, the bricks or blocks forming the wall or partition E on which the table D is supported are tapered or curved at their lower ends. The object of making them this shape is to ensure that the gas-jets striking against them are broken up. Furthermore, the burners may be mounted on flexible or swivel joints, so as to permit of the gas-jets being directed against the underside of the table, or against any other desired points.



In the alternative form of furnace shown, the separate bed or table is dispensed with—this part being represented by the bottoms of two muffles J within the furnace, and having projecting up between them the partition or baffle E. Upon the top of the two muffles there is also placed a tile or plate K, to seal the outlet to the gases at this point. The operation of this form of furnace is the same as that already described. The gases enter through the lateral openings H, and strike against the partition or baffle E, which deflects the flames upwards until they strike the tile K, which turns them downwards so that they pass around the outside of the muffles and strike the top of the furnace; the products of combustion escaping, as before, through I.

* See "JOURNAL," Vol. XC., p. 369.

Controlling Mechanism for Use in Connection with Systems of Lighting.

SPENCER, A., of Cannon Street, E.C.

No. 13,815; June 14, 1907.

The primary object of this invention is to provide apparatus suitable for enabling the lights of a train to be regulated as desired; but it is also suitable for use in other lighting installations where it is necessary or desirable to regulate the light.

It is proposed that each light, or each group of lights, of an installation should be controlled by an electrically operated device, consisting of a motor of any suitable kind, the armature spindle of which is connected to the light-controlling device proper through mechanism comprising a pin and slot or other lost-motion device such that at each operation of the motor, its spindle, or a part connected to it, moves before the controlling device proper is actuated, whereby the momentum of the rotary armature and attached parts is utilized to move quickly the controlling device proper, as by causing it, or a part connected with it, to be smartly struck in such way as to suddenly set it in motion—the controlling device proper being at the moment of striking free to move in advance of the motor-driven part.

In one arrangement of apparatus embodying this invention and adapted to regulate the gaslights of a railway train, there is included in the gas-supply pipe, at one end of each coach, a plug cock adapted in one position to allow the passage of a normal supply of gas to the several burners of the coach, and in another position to only allow sufficient gas to pass through a bye-pass to just keep the gas alight at the burners. The plug of this cock is connected by a lever arm and link to a pin on a disc loosely mounted on the armature spindle of a small electro-motor. Another disc, fixed to the armature spindle immediately behind the loosely mounted disc, is connected to it by screws which pass through arc-slots in it, and are screwed into the fixed disc—the heads of the screws preventing the loosely mounted disc from moving endways on the spindle.

APPLICATIONS FOR LETTERS PATENT.

756.—KREUZBERGER, E., "Incandescent gas-lamps." Jan. 13.
769.—MILES, T., and ROBERTS, G. J., "Gas-governors," Jan. 13.
793.—GRAETZ, M., "Inverted burners." Jan. 13.
794.—GRAETZ, M., "Heating-stoves." Jan. 13.
796.—AUBERT, A. M. and J. M., "Electrically controlled apparatus for igniting and extinguishing lamps." Jan. 13.
829.—STEWART, W. and J., "Gas-producers." Jan. 14.
837.—SHARPE, W. C. and W. C. jun., "Air gas." Jan. 14.
841.—KIRBY, W. C., and TAYLOR, W., "Manufacture of coal gas." Jan. 14.
887.—PEISER, M., "Inverted mantle holders." Jan. 14.
919.—DURRANT, F., "Gas-stoves." Jan. 14.
954.—DARWIN, H., "Gas-regulators." Jan. 15.
966.—RIES, H., "Water-vessels for gas-retort furnaces." Jan. 15.
977.—ALLATT, J. D., "Gas-governor." Jan. 15.
999.—KNAACK, H., "Gas-heating plant." Jan. 15.
1026.—KRIEGEL, M., "Supporting mantles." Jan. 16.
1074.—PÖSCHL, A., "Incandescent burners." Jan. 16.
1087.—GERSTENBERG, H., "Treatment of water-bearing areas for the supply of towns with pure underground water." Jan. 16.
1124.—WOODALL, H. W., and MOON, P. G. G., "Safety tap." Jan. 17.
1143.—FURNISS, F. G., "Turbine gas-engine." Jan. 17.
1186.—LAWRENCE, J. H., "Gas-heated irons." Jan. 18.
1206.—COOKE, H. S., "Lighting lamps externally." Jan. 18.

The Water Supply Difficulty at Exmouth.—Arising out of the difficulty which was experienced in maintaining the supply of water at Exmouth last summer, a writ has been issued against the District Council. It will be remembered that, owing to the depletion of the quantity of water in store towards the close of the summer, the Council were under the necessity of obtaining a supplemental supply. Water was pumped from the Yettington Brook, and by this means the immediate difficulty was overcome. Messrs. James Bros., owners of a mill, now claim damages for wrongfully diverting or abstracting water from the brook, and they ask for an injunction to restrain the Council from doing so in future. The Council have given instructions for the necessary steps to be taken to defend the action.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Rating: The Ipswich Ruling.

SIR,—Your readers can hardly over-estimate the importance of the recent decision of the King's Bench Division of the High Court on this appeal as it stands, because it puts an end to the suggestions which have been so vexatiously pressed in recent discussions on rating in and out of Court—that the Lee case afforded no precedent for chattels beyond the ordinary consumers' meters as then existing, and could not cover stoves and general fittings. It is difficult to differentiate in the smallest degree between the meter and any other such fittings and apparatus that could in no sense be considered as attached to the freehold of the hypothetical gas-works landlord; but it is just as well that the objections have been authoritatively disposed of.

It has been urged that the extensive development of the use of gas through the hiring-out of such apparatus was gradually extinguishing the landlord's rent, and therefore the rateable value of the gas-works and mains. Though not wholly true, because in some instances the "saturation" point of the population has been nearly reached, it is true that the increase of tenant's interest, coupled with the decrease of profits earned under the lower rates of dividends now prevailing, have largely reduced the rent obtainable.

All statutory companies have had, since 1875, to raise their capital at market price either by tender or auction, so that the whole earnings for dividends are reduced from the old standards of 10 and 7 per cent. down to 4 or 5 per cent., according to the popularity of the particular undertaking. On the other hand, the tenant's chattels hired to the consumers are enormously increased in number and value. Thus the formula of the hypothetical tenant's limited interest in his trade, originally adopted to shelter the valuers from the illegal assessment of trade profits (in violation of the Act, 3 and 4 Vict.), no longer yields the fat rents which could be worked out when the profits contained 10 per cent. dividends, and often contributions to reserve, while the tenant's chattels covered only his tools and such meters as did not belong to the consumers, who formerly often provided their own. It has always been doubtful by decided cases, like the Cambridge gas case, whether this formula did not radically infringe the Act eliminating trade profits, because it bases the landlord's rent directly on the profit, subject only to limited deductions for tenant's insurance and trading return.

In practice, the hypotheses surrounding this theory are numerous and vague, giving wide scope for differences; so that when worked out by experts, occasionally interested in swelling the amounts, and backed by powerful Assessment Committees with the run of the rates, to fight the aggrieved undertaking, some hardships arise, as happened exceptionally to one gas company, where the assessment resulted in rates amounting to 5d. per 1000 cubic feet on the gas sold. Other cases of hardship have been noticed in small undertakings, where the cost of getting redress was altogether disproportionate to the burden, and where the risk was great, owing to the difficulty generally experienced of finding a tribunal which would take the trouble to follow out the involved calculations upon the numerous hypotheses necessarily presented on this formula by the efforts of the assessors to escape the illegality of assessing profits.

The Quarter Sessions decision is safe against appeal if only it decide no point of law, but decides the fact as to the amount of value. Here, again, there is a stumbling-block for the appellants. In most counties, they can never learn till after they have stated their own case and figures on appeal what the foundation has been for the assessment which aggrieves them. If the practice were that the valuers should have to explain and justify their increased valuation, it would be very much fairer.

But it is notorious that assessment values are piled up upon the most superficial reference to the accounts furnished, and without any sufficient taking of particulars of the land and works. On the other hand, the parties assessed are often asked at short notice to supply particulars which are tedious and expensive to ascertain, and which, strictly, the opposite side should obtain for themselves. Inasmuch as on the appeal the aggrieved parties are to give evidence first, it is relied upon that their witnesses can be made to give any particulars necessary to the opposing valuer in time to enable him to make the most he can in support of the figure he has previously guessed at, or obtained by applying an arbitrary percentage scale to the receipts of trade, such as happened to result from some previous proceedings on different accounts.

No wonder that your columns have been filled from time to time with papers and letters containing tables of comparison showing the greatest inequalities, and pointing out how unsatisfactorily this hypothetical tenant formula can operate. Under it, there is clearly needed the greatest independence and impartiality of a competent valuer, applied after the fullest investigation of the facts, instead of depending, as now, on the chance decision of a tribunal with very little practice or experience, upon the contradictory and often widely extreme evidence offered on the opposing sides.

Can we wonder that, in such a position, the tribunal reckons out for itself that, on the admitted expenditure of capital in works and mains, a landlord would expect a sufficient interest on his outlay so long as the tenant's business was thriving? In this way we get, not a hypothetical tenant depending on many disputed hypotheses as to his duties, his capital, his risks, and his profit, but a hypothetical landlord with only one hypothesis—viz., the interest on his ascertained outlay. Unfortunately, the published accounts do not show the distinction between capital sunk in land, buildings, plant, and pipes, as distinguished from that sunk in the endless ramifications of the tenant's trading; so that on this method the Court may go wrong if they conceal from the parties what is in their minds, and may take incorrect amounts from the accounts.

Looking to the uncertainty of the present methods and customs, and to the fact that the capital found for gas purposes no longer receives an interest above 4 to 5 per cent., as against (say) over 9 per cent. 25 years ago, while in the same time probably the chattels of the tenant have quadrupled, clearly the time has arrived (notwithstanding the favourable decision in the Ipswich case) when we should press for some reform, and when our undertakings should no longer form the happy hunting-grounds for gentlemen, occasionally on commission, and some with what the town clerk of an important city in the Midlands once described as "shark" tendencies.

The consideration suggests itself whether a simpler method would be: That upon the landlord's expenditure, carefully valued and separated from the rest of the capital, a rate of interest clear of maintenance and insurance and all cost of administration should be fixed, having some relation to the current rate at which the undertaking is raising its capital. This would probably not give the tenant his full 17½ per cent. on his capital; but it would save him from having to fight for his life every five years or so.

As to the fairness of this 17½ per cent. tenant's allowance, it is submitted that a good deal of misconception exists from not looking at it sectionally divided, as it is, into three provisions.

(1) *Interest.*—The tenant could get 5 per cent., or very near, for his capital invested in good gas shares, which presumably he would sell to get the money to carry on the undertaking that he would rent.

(2) *Insurance.*—An Insurance Company would hardly take less than 2½ per cent. on their capital, equal to about 1¾ per cent. on the gross income, to secure them against a strike (such as the Dublin Gas Company have suffered this mid-winter), or an advance in coals of 33 per cent. (which happened last year generally), or for an explosion in the consumer's premises traceable to the hired fittings (as will happen).

(3) *Profit.*—The above deal with 7½ per cent., leaving 10 per cent. on the tenant's capital, which equals only 7½ per cent. on his gross receipts. Will anyone honestly say that such a percentage on the turnover is undue, bearing in mind what traders and contractors of all kinds generally look for?

So much, therefore, for the bugbear of the 17½ per cent. Until some weighty authority overrules it, we must continue to claim it on such an unsatisfactory theory as that of the hypothetical tenant.

This letter is already too long. I must reserve further observations for the present.

Palace Chambers, Westminster, S.W., Jan. 25, 1908. HY. E. JONES.

Gas and Electricity in West Ham.

SIR,—I note with interest the remarks in "Electric Lighting Memoranda," in your issue of the 21st inst., and I wish to draw your attention to a point which will undoubtedly concern both the electric and gas supply interests in the near future. I have a house which was lit by incandescent gas. I took on electricity (osram lamps) at 3d. per unit, and have at least as good a light as before at less than half my previous cost. My average cost will work out at less than 7d. per week, for twelve lights installed. I see that, according to the last few lines in your article, the gas people would be able to beat this by bijou gas-mantles to one-third of my present cost. This means a revenue to the Gas Company of less than 2½d. per week; but the Electricity Department (West Ham) notify me that they can even beat my present cost. My question is this: Presuming that both the electricity and gas supply authorities can light my house for 4d. per week (17s. per year), can it pay them to do so? Surely this revenue would not be sufficient to pay standing charges for either electricity or gas. I may say I shall be interested to hear your readers' opinion on this.

I might mention that the West Ham Electricity Department formula for getting out the cost of electric lighting by dividing the total number of burning hours by 11 to give cost in pence is actually even worse than they can do; my observations making the divisor 12.

Jan. 22, 1908. A SHAREHOLDER IN BOTH ELECTRIC AND GAS COMPANIES.

P.S.—Since writing, a printed note is to hand from the West Ham Electric Supply as follows: "Electricity is cheaper than gas, and won't blow you up."

[Our correspondent is either a rigid economist, or he has an electricity meter that fails to properly register his consumption. If the former is the case, we do not know whether to congratulate him; if the latter, we do congratulate him, but, in the interests of public morality, suggest that the Electricity Department of West Ham should look into the matter. But let us see what our correspondent's main statements work out to. He pays, on an average, 7d. per week for electricity; and he has twelve Osram lamps fixed in his house. He does not tell us several things that it is desirable to know to put his figures through a test. He does not, for instance, inform us as to the nominal candle power of his lamps. He does not tell us the voltage of his supply—whether it is 100 or 200, or upwards. It is therefore impossible to judge whether his lamps are fixed in pairs or singly. We will therefore proceed on the assumption that they are fixed singly, so as to give him all the advantage possible, and that they are of the nominal 32-candle power variety. Now if he will look at the "Illuminating Truths" article in this issue of the "JOURNAL," he will see that electricians assure us that a fair sample of a 32-candle Osram, giving 29·1 candles actual, uses 1·32 watts per candle, or 38·41 watts each per hour. Our correspondent spends an average of 7d. a week on electricity, which means, at 3d. per unit, an average of 2 33 units per week. Seeing that a 32-candle power lamp uses 38·41 watts per hour, twelve would dispose of 460·92 watts in an hour. Therefore, if the twelve lamps were all used at the same time, they would run away with the 2·33 units in 5·5 hours; and 5·5 hours' lighting spread over a week would not, we fancy, satisfy the most rigid of econo-

mists even in the summer time. Supposing six lamps are used at the same time—and 29·1 candles × 6 lamps = 174·6 candles distributed through a house is in all conscience little enough to make it bright, convenient, and comfortable—the average of 2·33 units would last eleven hours in a whole week. Very early to bed and late to rise principles must be practised by our correspondent. Gas in West Ham costs 2s. 9d. per 1000 cubic feet. A penny will therefore purchase 30·3 cubic feet; and 7d. 212 cubic feet. Now six incandescent burners, using 3½ feet an hour each, would give (64-candle power × 6 = 384 candles) a rather higher candle power than the twelve Osram lamps combined. These six lamps would burn in an hour 21 cubic feet, which would allow the six lamps to run continuously for ten hours on the 7d. spent on gas—that is to say, about double the time the twelve 32-candle power Osram lamps would run. Three of these 64-candle power incandescent burners would give as much light as six 32-candle power Osram lamps; and they would run for twenty hours a week on 7d. spent for gas. But supposing our correspondent used bijou gas-burners, either in pairs or singly as his requirements necessitated, giving a light of about 25 candles each for 1·3 cubic feet of gas, he would find his 212 feet would go a very long way in a week, and enable him to enjoy a greater number of lighting hours than 7d. of electricity can possibly do. He need not (as a shareholder) bother his head about the standing charges for gas. The price (for ordinary supplies) per 1000 cubic feet includes everything; and whether little or much is sold to a single consumer, he pays his proportionate share of the charges involved in production and distribution. It is not illumination that is sold; it is gas. However, such consumers as our correspondent will not do much to help the West Ham Electricity Department out of the financial difficulties disclosed by the last accounts, through the prices charged not meeting the outgoings and obligations of the department.—ED. J.G.L.]

Slot-Meter Clause in the Padiham Bill.

SIR,—In your "Editorial Notes" of this week's issue, reference is made to the clause in the Padiham Urban District Council's Bill relating to slot-meter consumers. May I be allowed to point out the reasons why this clause is included?

About two years ago, my Committee adopted what is best known as the free-cooker scheme for slot consumers; and, as a safeguard against the cooker not being used, and also to encourage consumption in the summer (during which time, as you are aware, the slot consumer is not a very profitable one), they decided that, where the consumption in any one quarter did not reach 3000 cubic feet, the consumer must pay a rent of 6d. for the hire of the cooker for that quarter. This rent is the same in amount as is charged to the ordinary consumers for a similar cooker. The Committee intend the clause to apply to the slot consumers only, where free cookers are in use.

The system has been working very successfully during the two years it has been in use, so that the Committee feel justified in placing the clause in the Bill, which is being done to put the system in order.

I may mention, in conclusion, that I believe many towns have practically the same system in use.

Padiham Gas-Works, Jan. 23, 1908. A. J. HARRISON.

The Comparative Value of Gas Coals.

SIR,—The rule given in the "Handbook" for calculating the relative value of different coals, is quite correct, and will if followed give approximate values.

In the application of the rule, however—as Mr. Sutcliffe points out in his paper read before the Yorkshire Junior Gas Association—I am wrong in putting such a high value on the sperm; and although this high value is attached to the sperm in both the coals that are being compared, and so at first blush might be considered to offset each other, yet that is clearly an error, and one that ought to have been corrected before.

I cannot recall the train of reasoning that led me to adopt the "1s. per lb." value of sperm. Probably it was (as Mr. Hill suggests) the price of sperm candles that was present to my mind. In the next edition of the "Handbook," the calculation shall have my attention.

I am writing under unfavourable conditions—prostrated by a severe chill, caught earlier in the week. Else I would have made further comments on Mr. Sutcliffe's paper and on the interesting discussion that followed.

Knutsford, Jan. 25, 1908. T. NEWBIGGING.

Rhymney and Aber Valleys Gas and Water Bill.—The Rhymney and Aber Valleys Gas and Water Company are promoting a Bill for the revival and extension of powers for the construction and completion of a reservoir and other water-works authorized by former Acts, and also to enable them to construct additional gas-works at Caerphilly. The Gelligaer Rural District Council, at a special meeting, decided to oppose the Bill; the resolution in favour of this course being carried unanimously. Mr. Hopkins, who proposed it, said that in April, 1898, the residents of Gelligaer gave over to the Company the powers of gas and water supply for the district—recognizing at the time that a large sum would be required to meet the needs of the place. They all knew of the difficulties through which the Company had passed; and they anticipated that, with the new Manager, many of the defects in the system, from which they had suffered, would be remedied. The Company, however, did not propose to make an efficient supply of water at Fochriw; and it was therefore necessary that the people should protect themselves and oppose the preamble of the Bill. In respect to gas, a reduction in price would be a boon to the ratepayers.

LEGAL INTELLIGENCE.

QUALITY OF BRENTFORD GAS.

The Company Fined for Deficient Illuminating Power.

At the Acton Police Court last Tuesday, before Mr. G. WRIGHT (Chairman) and other Magistrates, the Brentford Gas Company were summoned by the Chiswick Urban District Council for failing, on the 10th of October last and the 15th inst., to supply gas of the statutory illuminating power.

Mr. TRAVERS HUMPHREYS (instructed by Messrs. Lees, Butterworth, and M'Donnell) appeared for the Council; Mr. R. J. NEVILLE (instructed by Mr. H. E. Griffith) represented the Company.

Mr. HUMPHREYS, in opening the case, said the proceedings had been taken under section 36 of the Gas-Works Clauses Act, 1871, which provided that if it should be proved to the satisfaction of any two Justices that on any day the gas was of less illuminating power than it should be, the suppliers should in every case pay the local authority a sum, not exceeding £20, which the Justices should determine. The Brentford Gas Act of 1868 specified that the gas should be of such quality as to give, when consumed through an argand burner having 15 holes and with a 7-inch chimney, passing 5 cubic feet of gas per hour, a light equal in intensity to that produced by 14 sperm candles of six to the pound, each consuming 120 grains per hour. The Brentford Gas Order of 1881 provided that any local authority having jurisdiction within the limits of supply might, at their own expense, provide a gas-testing place; and they were also empowered to appoint a competent and impartial gas examiner to test the gas supplied by the undertakers. The Chiswick Urban District Council provided a testing-place at the Town Hall, and there the examiner used the apparatus prescribed. It was permissible to test the illuminating power of gas supplied within the hours of five and ten o'clock in the evening during the period from the 1st of October to the 31st of March inclusive. In this case, all the required conditions in regard to testing had been complied with. A question which might arise was with regard to the provision that the Company should, if they thought fit, be represented at the tests, though their officer was not allowed to interfere. On each of the two occasions upon which it was proposed to carry out tests, notice was given to the Company about half-an-hour before the time of making them, and a carriage was provided for the conveyance of the representative; but no official from the Company attended. The reason the notice given was not long was that if one of several hours had been given it would have been a simple matter for the Company to improve the quality of their gas in the meantime. The tests were made about seven o'clock in the evening; and on the 10th of October it was found that the illuminating power was only 11·13 candles, instead of the minimum of 14 candles prescribed by the Act. On the 15th inst., the illuminating power was found to be 11·24 candles. The Company's main question would probably be in regard to the burner used for testing the gas. In 1868, there was one well-known burner which fulfilled the specifications of the Act of 1868—*i.e.*, the Sugg-Letheby burner, which had been, and was still, used by the Chiswick Council for making tests. As he understood, the Company held that for testing they were entitled to take advantage of scientific advance and improvements in gas appliances, and employ a burner brought into use after the passing of the 1868 Act, but which still complied with legal requirements. Their suggestion was that they were entitled in 1908 to supply gas of inferior illuminating quality to that which they had to supply in 1868, if they could, by the aid of a better burner, bring it up to 14-candle power. If the Company thought in 1908 that it was a little hard to still use a burner which was in accordance with an Act passed in 1868, then surely their remedy was to go to Parliament and ask for authority to use a better one, on the ground that the 1868 burner was obsolete. If they asked Parliament, they might be allowed to use a better burner; but they would be required to supply gas of 16 or 18 candle power.

Mr. NEVILLE remarked that the present tendency was to reduce the illuminating power of gas.

The CHAIRMAN (interposing) said the point the Court had to decide was whether or not the terms of the Act had been carried out by the Company.

Evidence having been given as to the appointment by the Chiswick Council of Mr. Frederick F. Shelley as a gas examiner, the latter gentleman deposed to making the tests. He stated that on Oct. 10 the average of his ten observations was 10·89 candles uncorrected and 11·13 candles corrected; while the result of the test on the 15th inst. was that the uncorrected average was 11·37 candles and the corrected one 11·24 candles.

In cross-examination, witness said he had not been gas examiner to any other body than the Council. As the result of communication with many gas undertakings, it was found that several used a similar burner to that which was employed by the Chiswick Council. Not being familiar with Acts of Parliament, he could not mention any measure in which the Sugg-Letheby burner was prescribed by name. He would not go into the question as to whether a burner which had been employed by the Company for the last thirty years, which was used by Dr. Letheby in testing against the Company, and which had been approved by Parliament as a proper burner for the Wandsworth and Putney Company (a 14-candle power Company), was not a proper burner for Brentford. He did not know what the atmosphere of the room was at the time of making his tests.

Mr. NEVILLE: Do you not know that the condition of the atmosphere is one of the most important things in finding the illuminating power of gas, and that it is specified by the Metropolitan Gas Referees that you have to correct both for temperature and pressure?

Witness said he was not testing according to the rules of the Gas Referees. The only temperature he had to take notice of was the temperature of the gas. In answer to further questions, he said he had not washed out the service-pipe leading to the testing-place, and did not think there were any means of doing so. He did not think it necessary to make three sets of ten observations, making three tests,

as he thought one set of ten observations showed accurately the illuminating power of the gas. He had tested three times, making thirty observations. Asked if it was not a fact that the third test was always higher, witness said he could not remember. He, however, was fully satisfied that in making his tests he complied entirely with the conditions of the Act.

Mr. *Frank L. Teed*, D.Sc., said he was for twenty years one of the Gas Examiners to the Metropolitan Board of Works and the London County Council, and was in practice as an analytical and consulting chemist. He was present at the second test of the defendants' gas on the 15th inst. As far as he knew, there was no better argand burner in 1868 than the Sugg-Letheby, and the improved argand burners now procurable had been put upon the market since that date. He checked Mr. Shelley's observations, and the test was absolutely fair, having been carefully and accurately made. He agreed with the result as to the illuminating power of the gas given by Mr. Shelley.

In cross-examination, witness pointed out, with regard to the Gas Referees' instructions as to making three tests, that the conditions in London were different. There one could test at any time; but in the area in question in the present case the hours were much restricted. He thought it fair, in testing against a company, to take one set of observations. There was a tendency for the result of the third test to be higher, when the room was badly ventilated. A plumb-line for the adjustment of the candles was not necessary; and the test he attended was carried out in absolute accordance with the Act.

Mr. *Isaac Carr* gave evidence of a corroborative character in regard to the argand burners; remarking that the improved burners of this class increased the photometric power of gas.

In cross-examination, witness said the introduction of new burners had led to a great deal of confusion and misapprehension as to what the quality of gas was; and he should not think the confusion in 1868 was anything like what it was now. A single cubic foot of gas per hour used with an incandescent mantle was worth about five times as much as it was with a flat-flame burner; but good quality was essential for every purpose. The value of 1-candle power to a gas company was variously estimated. Counsel suggesting it was worth 1d., witness replied that it depended upon the cost of material.

Mr. NEVILLE remarked that, seeing the difference between the Brentford Company's burner and that used by the Chiswick District Council was something like three candles in developing the illuminating power of the gas, and, taking the price per candle at 1d., it would mean 3d. more on to the Company's cost if the Sugg-Letheby burner were used. It really meant that if the Local Authority were right in using the burner they did, the result of the prosecution, if successful, would be that 3d. more per 1000 cubic feet would have to be charged for gas.

In further cross-examination, witness agreed that there had been an enormous increase in the use of incandescent burners, but thought some consideration should be given to the many users of the flat-flame kind.

Mr. *Arthur Valon* agreed generally with the evidence given by Mr. Carr. He said in his opinion the tests were fair and proper, and in accordance with the Act of 1871. If naphthalene had been in the service-pipe, it would not have affected the illuminating power of the gas, but merely the pressure.

Cross-examined by Mr. NEVILLE on this and other points, witness said the Gas Referees had endeavoured to remove all possibilities of error, even though they were microscopical; and naturally their instructions had to be carried out at the testing-places under their control. He did not agree that it was necessary to have more than one set of ten observations; and though he could not give an example of a conviction based upon a test with one set, he thought there must have been cases. He disagreed with Counsel's contention that the Act required more than one test.

Mr. NEVILLE, for the defendants, contended at the outset that, in order to test gas efficiently against a company, it was necessary that the test should take place at an "official" testing-place, and that the Chiswick Town Hall was not such a place. Under the Act of 1868, the Company had to provide and maintain, in some convenient part of their works, a proper testing-place, to which access had to be given to the Local Authority. He complained that the testing-place at the Town Hall was unsuitable; being, in gas parlance, at the end of a "dead" main, and in a basement. He incidentally mentioned that the London County Council put up a testing-place in Spring Gardens; but though they tried several times to make use of tests taken there for the purpose of prosecution, it was finally found necessary for them to obtain an Act of Parliament. Special power would have to be given to the Chiswick Council to enable them to test at the Town Hall, if the test was to be the basis of a prosecution against the Brentford Company, as they had no power under the Act.

The CHAIRMAN remarked that he thought the section was perfectly clear.

Mr. NEVILLE: If you are against me, I shall have to ask you to state a case, because it is a question which is of great importance to gas companies.

The CHAIRMAN thought the section in question was intended to convey that, unless a local authority felt disposed to go to the expense of putting up a place of their own, they were at liberty to go to the place which the Act said the undertakers must provide.

Mr. NEVILLE further submitted that reasonable notice of the testing had not been given, and that the Company should have had three hours' notice if personally served upon the Engineer, or six hours' notice if served in writing at the works. These, however, were technical points; the real fight was on the question of the burner. He referred to the great change which had taken place in the manufacture and use of gas since 1868, and pointed out that incandescent mantles had greatly increased the illuminating power. What was now required was gas of uniform quality suitable for lighting, heating, and motive power. This was what gas companies had been striving after for years; and they wanted a gas which should also meet the standard prescribed by the Act. The object of the Brentford Company was to supply gas as cheaply as possible, because it would be of greater public benefit to do so, and also because it was impossible to increase their dividend until the price was lowered. If the price was reduced 1d. per 1000 cubic feet, five-sixths of the penny went to the consumer, and the Company were entitled to increase their dividend by 5s. per cent. In order to induce gas companies to sell gas cheaply, Parliament authorized a sliding-scale; and they fixed the price of gas for Brentford at 3s. 9d., and said the dividend should be 10 per cent. if it was earned. For every 1d. per 1000 cubic feet reduction, their dividend increased 5s. per cent.; but for every 1d. advance, it decreased 5s. The Company had not raised their price since 1881, not even temporarily; and it was now 2s. 9d. Seeing that for every 1d. reduction the consumer received five-sixths, 10d. out of the 1s. reduction made since 1881 had gone to the consumer, and 2d. to the Company. In spite of all changes effected in the manufacture, use, and price of gas, were the Company to be tied down to one particular obsolete burner? He argued that the burner they used came fully within the meaning of the Act, and conformed to all its stated requirements.

In reply to the Chairman, Mr. NEVILLE said he contended that if the Company could, by the aid of an improved burner, supply gas of 50 per cent. lower quality and maintain the illuminating power as required, they were at liberty to do so. The great object of the Legislature was that gas should be within the reach of all; and the Company were entitled to profit by the advances of science. They could not be bound to go back to obsolete methods which had been discarded by engineers. He held strongly that there should be more than one set of ten observations to constitute an "official" test.

Mr. *W. C. Young* said he had had more than forty years' daily experience in testing gas. In the City of London, notice had to be given on the day previous to the test being made. At West Ham, three hours' notice had to be given; and it was the same with the South Suburban Gas Company. He held that the Chiswick testing-place was unsuitable. It was in the basement of the Town Hall, and the apparatus was subject to draughts, which affected the form of photometer used there. The room was lighted, otherwise than by the one gas-burner, by electric lamps; and the circulation of gas would certainly not be sufficient to ensure obtaining a fair sample of gas. The Brentford burner was one which was thoroughly efficient; but the Sugg-Letheby burner was a "poor thing." The Wandsworth and Putney Company's gas was a 14-candle one. They were under the Act of 1871; but they went to Parliament in 1906, and Parliament said they were entitled to use the Brentford burner, and no difference was made in the standard illuminating power or price of their gas. When testing, it was necessary to take three sets of observations, and four if the result was adverse to a company. Every gas examiner with whom he was acquainted, apart from those who had appeared, thought three sets necessary to ensure a fair test. It had been his experience that the third test had invariably given a higher result. He tested the Company's gas on the 10th of October with a Brentford burner; and the average was 14·86-candle power. The result of the first test was 13·25 candles, and of the third test 15·27 candles. He thought the Brentford burner was about 3 candles better than the one used by the Chiswick Council. He made further tests on the 15th inst.; and the average of three was 15·03 candles, the first result being 14·38 and the third 15·56 candles. He thought the presence of naphthalene in the service-pipe would very appreciably affect the illuminating power of the gas; and if the pipe was cleared out by one of the Company's officials on the 5th of October, a deposit might well have been present on the 10th. I 40 gas-jets were kept burning in the building and the gas was kept circulating, it was certainly all in favour of the gas.

Mr. *A. A. Johnston*, the Company's Engineer and Manager, said they had gone to much trouble to ascertain what were their rights under the Act with regard to burners, and had endeavoured to carry out the advice of distinguished legal authorities. It had been their aim to have the best burner coming within the requirements, and one which would best develop the illuminating power of the gas. The old burner was not only obsolete, but quite unsuitable for burning gas. During the half year ending the 22nd of December, 152 tests of gas were made by the Company, and they gave an average of 14·28-candle power; 134 tests at Chiswick gave an average of 14·69 candles; 51 tests by Mr. Young an average of 14·84-candles; 74 tests at Barnes an average of 15·27 candles; and 156 other tests an average of 14·71 candles. At the present day, the tendency was to decrease the illuminating power of gas. It the Company supplied a gas of high illuminating value, the consumer obtained a worse result from it than he did from a gas which was made to suit the requirements of his apparatus. Of the gas supplied to-day, 75 per cent. was consumed with atmospheric burners. Gas of uniform quality gave the consumer a better result in present-day apparatus than gas of higher illuminating power.

In the result, the Bench decided in favour of the District Council; holding that the testing-place was "official," that it was not unsuitable, and that the notice given was not unreasonable. As to the burner which should he used, the Justices held that the Act of 1868 set up a standard or measure by which the illuminating power of gas should be tested, and that the test should be made by an argand burner of that date, such as the one used by the Council. They imposed on the Company a penalty of £10 on each summons, and 100 guineas costs. They, however, consented to state a case on the points regarding the burner, the testing-place, and the notice.

East Metropolitan Power-Gas Supply Bill.—The provisions of this measure were considered by the Woolwich Borough Council at their meeting last Thursday, and the proposal of the Law and Parliamentary Committee that a petition should be presented against the Bill was adopted. The Committee expressed the opinion that should the Bill become law the British Coalite Company, Limited, who would then be able to supply power gas in the boroughs of East and West Ham, as well as in the urban district of Barking Town and in North Woolwich, would be a serious competitor with the Council in the supply of power, for which, it was said, there was a large and remunerative field in North Woolwich. The Committee also thought that the interests of the Council were seriously threatened by the powers sought as to the breaking-up of streets. The Council did wisely in adopting the proposal of the Committee; but their action has been rendered unnecessary, for, as will be seen from our editorial columns, the Bill has been withdrawn.

MISCELLANEOUS NEWS.

MUNICIPAL ELECTRIC LIGHTING ACCOUNTS.

A Revelation from Bermondsey.

The Engineering Supplement to "The Times" last Wednesday contained a letter from Mr. R. Stewart Bain, the Managing-Director of the London Electric Supply Corporation, Limited, referring to two previous communications on the subject of the auditing of municipal accounts, and enclosing an abstract of a letter he had addressed to the Local Government Board in connection with the electricity accounts of the borough of Bermondsey for the year ended March 31 last. He thought the abstract might be of interest as showing how municipal trading is carried on in the borough; and he expressed the opinion that, if the accounts of other boroughs owning electric lighting undertakings were investigated in like manner, they would show a similar condition of affairs. The following is the abstract referred to.

The letter calls attention to the manner in which the electricity accounts of the borough of Bermondsey are understated by transferring items of expenditure, which in the case of electric supply companies' accounts would require to be charged to the revenue account, to the general rate account, and shows how, by means of such understating, the accounts are made to show a profit instead of a loss. It states that the Company were represented by Counsel at the audit of the borough accounts last year, and shows how the objections they raised therein were dealt with by the Auditor.

(1) *Public Lighting.*—The rate charged for this was 2¼d. per unit, though the Company had made an offer to supply them with current required for public lighting at the rate of 1⅝d. The Auditor had not the power to make any reduction; but in the accounts to March 31, 1907, the rate charged was 1¾d. This reduction, though in excess of the rate offered by the Company, and much in excess of the rates offered under their published scale for a similar load, is still a decrease of about 22 per cent. on the rate charged last year, and ought to have shown a saving of about £745 in the accounts, instead of which the amount charged is £3675, or an increase of £285. The number of public lamps was the same in both years.

(2) *Dust Destructor.*—It was shown that the dust destructor was installed in connection with the electricity generating station. Previous to its installation, the borough got rid of its dust at a cost of 2s. per ton. The dust destructor has increased this to 5s. 7d. per ton; but no part of this has been charged to the electricity accounts. The Auditor held that "the dust destructor is incurring a charge to the rates of fully £3000 per annum in excess of other methods of disposal of the dust." But, in law, it is a separate undertaking chargeable to the rate fund, and he was not justified in charging its cost against the electricity accounts. The Company then adduced evidence to show that the amount charged for the steam was inadequate; and, as the result of this evidence, the Auditor increased the amount for the value of steam from £580 to £885. In the opinion of the Company's experts, this amount is quite inadequate. They were prepared to accept a suggestion made by the Town Clerk to submit the matter to an expert appointed by the Board of Trade—his fees to be paid by the Council if he reported against their figures, and by the Company if he upheld theirs; but the Council declined to confirm the offer of the Town Clerk. Though an amount of more than £32,000 has been expended on the dust destructor, no part of the expenditure has been charged to the electricity accounts.

(3) *Rates and Taxes.*—The amount charged in the accounts to March, 1906, was £403. If the undertaking had been assessed in the same manner as the Assessment Committee assessed the Company's undertaking, this should have amounted to £1030. In the accounts to March, 1907, the figures have been increased to £838, which is still considerably lower than they should be on the basis of the assessment of the Company.

(4) *Law and Parliamentary Charges.*—Sums amounting to £559 for the year ended March, 1906, were charged to the general rate account. The Auditor, in reporting upon this item, said: "There can, however, be no doubt that part of the burden so borne by the rates was due to the fact that the borough possessed this trading undertaking, and that, for the purposes of a comparison in the matter of profit and loss, account should be taken of this portion of these costs."

(5) *Depreciation.*—The Company held that the amount set aside was inadequate. The Auditor reported that the Council had complied with the requirements as regards loan repayment, in addition to setting aside £3000 as a reserve for renewals and carrying forward a balance of £700. In this year's accounts nothing is provided for renewals, and the balance carried forward is reduced to £590—showing a loss on the year's trading of £114 12s.

(6) *General Establishment Charges.*—The Auditor reported that the amount allocated to the trading revenue as a share of the general establishment charges was not sufficient, and that it should be increased by fully £100 per annum. For the year ended March 31, 1907, the charges have been reduced from £146 to £128.

Statements were enclosed showing that the borough sells to its own departments more than 50 per cent. of its total sales. The letter points out that the borough has expended on its undertaking £133,921 up to March 31 last. If the cost of the destructor is added, it makes a total expenditure of £165,921; and of the total sales no less than 50 per cent. is sold to its own departments at rates considerably in excess of those obtainable from a public supply.

The letter concludes by pointing out that the Company, who are substantial ratepayers and a statutory authority for the supply of electrical energy in the borough, are being competed with in an unfair manner—viz., by aid of the rates—and are being called on to contribute to the loss which is being incurred yearly by the Borough Council in carrying on its electric undertaking, and this in spite of the fact that by a clause in the Bermondsey Electric Lighting Order the undertaking thereby authorized should not be carried on by aid of the rates.

THE FERMOY GAS AGITATION.

Some particulars were given by the "Cork Weekly News" a few days ago with regard to the dispute between the Fermoy Urban District Council and the Gas Company which for the past two or three weeks has created, not only great excitement in the district, but has, it is stated, more or less dislocated the business of the town. The dispute has arisen over the price of gas; the Council, it is said, objecting to the Company's charges. Meanwhile, in some mysterious manner, the gas-mains have been flooded with water; and all attempts on the part of the Company to get rid of the obstruction have proved abortive—not for the want of trying, but by being frustrated by the Authority objecting to their roads being opened. The latest development, it is reported, is that for some days the Gas Company's men have been busy at the works pumping water out of the mains; but though thousands of gallons have been pumped out, the flow still continues, and very little progress appears to be made. How such a quantity of water could have got into the pipes is somewhat of a mystery, as both the officials of the Company and of the Council emphatically deny having caused it. During one of the attempts to open the road for the purpose of pumping, the Council's fire-hose was brought into play on the excavators; and they had to cease operations. In another part of the town, a similar effort was being made when a Council cart was drawn up loaded with stones, and the latter were dumped into the hole; and as the fire-hose was also again requisitioned ready for use, this effort to set things right proved a failure. The town, meanwhile, as far as gas is concerned, is practically in darkness—houses, shops, clubs, hotels, convents, &c., being completely cut off as the result of the water in the mains. The Company have offered to submit the question of their charges to arbitration; but this has been refused by the Council.

CROMER AND ITS ELECTRIC LIGHT WORKS.

The Council and the Recent Inquiry.

A report was published in the "JOURNAL" for Oct. 29 last (p. 362) of the proceedings at a Local Government Board inquiry with reference to an application by the Cromer Urban District Council for sanction to the borrowing of £8000 for electric light purposes. The proposals were strongly opposed by a portion of the ratepayers; while the Inspector (Mr. H. R. Hooper) did not seem wholly satisfied with the position of affairs.

Some significant admissions as to the position in which they find themselves were made at a recent meeting of the Council, when the Highways Committee, on the casting vote of the Chairman, recommended that twelve months' notice be given to Mr. E. H. Cozens-Hardy terminating his engagement as Consulting Engineer to the electricity undertaking. In seconding the adoption of this recommendation, Mr. Savin said, referring to the Local Government Board inquiry, he did not think that Mr. Cozens-Hardy did his duty to the ratepayers. He had now suggested a modified scale of charges; but he should have done this before the inquiry. Mr. Davidson asked whether it was advisable to part with Mr. Cozens-Hardy, who had had charge of the work from the beginning. He certainly thought they should await the reply of the Local Government Board. He believed he was correct in saying that Mr. Cozens-Hardy only had a retaining fee of ten guineas a year. Was it reasonable to expect to get a man to take up his position and be satisfied with this sum? He was not prepared to say that Mr. Cozens-Hardy had not made mistakes, and probably if they got another man so would he. In his judgment, it would be a very unwise policy to get rid of their Engineer, who had gone through every detail. He moved, as an amendment, "That it is not in the best interests of the town to get rid of the present Engineer."

The amendment having been seconded, it was supported by Mr. Puxley, who remarked that it was better to have the man they knew than one they did not. They were in a difficult position; and there was no one better able to get them out of it than their Engineer. As for all these complaints about him, why was he not brought to book before, and not after, the inquiry had been held? Mr. Broadhurst said it would be interesting to know what result was aimed at by the Committee's recommendation. If the object was to punish the Engineer, nothing could be more mistaken. If, on the other hand, it was to place difficulties and doubts in the way of the Council, the adoption of the recommendation would certainly succeed. The Engineer had done his work, on the whole, very well, with the exception of some difficulties that arose at the inquiry—difficulties which were presented most unexpectedly, without any notice or warning whatever. For weal or woe, they had this electricity concern. It was there, and it was theirs; and to keep on attacking it and all connected with it, only tended to increase difficulties and still further discredit it. The retention of the present Engineer was a condition essential to success, if success was to come. To discharge him would be one of the most fatal procedures that could possibly occur.

Mr. Lovelace, the Chairman of the Committee, said he gave his casting vote according to what he believed was right. He was never more disgusted in his life than when he heard questions put to the Engineer at the Local Government Board inquiry, which he was unable to answer. Mr. Curtis asked whether, if a loan was refused, Mr. Cozens-Hardy would help them out of the muddle. Would he find the money himself? The Chairman of the Council (Mr. G. W. Wilkin) thought that no such strict inquiry as their last one had ever been held in Norfolk. Mr. Cozens-Hardy was in no way prepared to answer the questions put to him; and many large ratepayers had expressed their surprise at what transpired.

On a vote being taken, the amendment was carried; and the recommendation with regard to Mr. Cozens-Hardy was therefore deleted from the Committee's report.

DEVONPORT WATER SUPPLY.

Effect of the Recent Frost—New Reservoir to be Built.

The severe weather at the end of last year, and the consequent failure of the Devonport water supply, will apparently have the effect of hastening the construction of the new storage reservoir, for which the Corporation obtained parliamentary powers in the past session. The opinion of the Water Committee had been that the expenditure might be deferred for a few years, until the effect of the other works which are being carried out for the improvement of the supply is ascertained. The Water Engineer (Mr. F. W. Lillicrap) has, however, reported strongly in favour of the construction of the reservoir at an early date; and the Committee decided last week to recommend the Town Council to commence at once, and instructed the Engineer to prepare the plans and estimates for the work. In his report, Mr. Lillicrap stated that on the 28th of December the leat was blocked with snow and ice for its whole length of 24 miles; and in consequence of the severe frost continuing, practically no water flowed into the reservoir from the leat for about ten days. On the 3rd of January, it was found necessary to obtain water from Plymouth to supplement the supply; and in five days they took a total of 9½ million gallons from the main of the Plymouth Corporation. This made the total quantity available for the ten days 33,266,600 gallons; and the average daily consumption for that period was 2,784,000 gallons. On the 7th of January, the Plymouth Corporation reported that, owing to a breakage of their trunk main, it was impossible to continue supplying Devonport with water. At that time there were only 5,421,000 gallons in the Devonport reservoirs; and had not the weather fortunately changed just then, the situation would have been very serious. For three days the 6-inch main which under the Act of Parliament serves the Dockyard was shut off entirely, and for several days it was necessary to restrict the quantity of water sent into the town. If the reservoir had been constructed, it would not have been necessary to curtail the supply. The cost of attempting to clear the leat from snow and ice was £183, and of the water from the leat £99. Mr. Lillicrap also reported that a leakage had been discovered at the Crownhill reservoir, and a subsidence had occurred. He had adopted measures to temporarily remedy this; but it would be necessary to take steps to render the reservoir water-tight as early as possible.

MERTHYR WATER SCHEME.

A Bill is being promoted by the Merthyr Tydfil Corporation, in which there was a clause to authorize the carrying out of certain waterworks, including an impounding reservoir on the Taff Vechan, and an aqueduct. The Bill was submitted to a crowded town's meeting recently, when it was taken section by section, and the portion relating to the water scheme was hopelessly defeated, after a long and stormy discussion. It is reported that only five of those present voted in favour of the water clauses. It has, however, been decided to take a poll of the ratepayers on the subject.

At a conference between the Water Committee of the Glamorgan County Council and the Water Committee of the Merthyr Corporation, on the 18th inst., the county representatives declared that they could not do otherwise than recommend the County Council to oppose the Bill, which appropriates the Merthyr water not wanted by them, but is wanted for the inhabitants of the county, unless the Corporation would come into the proposed Water Board, with all their works, on the same terms as other districts in the county. The County Council's proposals having been considered unacceptable by the Merthyr representatives, the following arrangement was mutually agreed upon: "The Merthyr Corporation undertake to insert in the filled-up Bill clauses giving the Glamorgan Water Board, if and when constituted, an option to take any quantity of water up to 9 million gallons per day at the southern boundary of the borough, under the pressure of the proposed Taff Vechan reservoir, without break of pressure through a main not less than 28 inches in diameter, upon the lines designated in the parliamentary plans, at 2½d. per 1000 gallons, such option to be exercised within three years from the passing of the Bill, subject to a minimum quantity of 3 million gallons per day. The Water Board to be at liberty to make connections with the main at a higher level if found convenient, and to be entitled to sell such part of the water as they may think fit." The reservoir is estimated to hold 2700 million gallons, and to yield 10 million gallons per day. The maximum quantity which the new Water Board will propose to take will therefore be within a million gallons of the total quantity the reservoir will yield. The Corporation do not intend (even if they get the powers) to construct the reservoir or spend any money until they know that the Water Board will exercise the option in the agreement.

In order that the arrangement above referred to may be properly understood, the "South Wales Daily News" has published some interesting information with regard to the matter. From this it appears that the Merthyr Corporation at present have three reservoirs, two of which—the Upper and Lower Neuadd—have a capacity of 350 and 75 million gallons respectively. The reservoir at Pentwyn, constructed in 1863, is leaking; and there are fissures culminating in a huge hole on the outside of the embankment. Through this hole 11 million gallons of water run to waste daily. The Corporation are advised that further attempts to repair it might cost any sum from £5000 upwards, with no more than the hope of reducing the leakage. Therefore, they decided to go to Parliament for powers to build a new embankment to impound 2700 million gallons of water at Pontsticill, and to leave the Pentwyn dam to its doom. Notwithstanding the state of the Pentwyn dam, there is available a surplus of 300,000 to 400,000 gallons per day beyond the million gallons per day now being sold under agreement to supply the Dowlais works; but it is estimated that if the population increases at the present rate, in six years, should a dry summer come, 91 per cent. of the present total available supply would be required to meet the needs of the borough. It is regarded as the duty of the Corporation to obviate as far as possible the obligation to cut off the supply to the Dowlais works at a time when the Company's ponds would be dry, for the effect would be to stop the works. In these circumstances, a new reservoir becomes more necessary than at first sight might appear; for a margin of 9 per cent. is too small for the Corporation to count upon in a time of drought six years hence. The huge reservoir that was proposed cannot be pretended to provide simply for the domestic requirements of the borough. On the contrary, it was suggested so that water might be sold to outside authorities, and that by the Bill the quantity of compensation water might be settled on a permanent basis of 7 million gallons per day. These were the considerations laid before the ratepayers; but they were rejected, principally because no customer, it is said, was forthcoming who would undertake to buy the water.

Contingent upon the formation of a Water Board for the County of Glamorgan, a customer has now been found in that new authority, for which an option has been secured by the County Council upon a quantity between 3 and 9 million gallons per day at 2½d. per 1000 gallons—the option to be exercised within three years. If the Water Board is formed, and if the Pontsticill—or, more properly, the Taff Vechan—reservoir is constructed, and if 3 million gallons of water are delivered daily, the Corporation will derive a revenue of £11,406 per annum; while if the whole quantity were delivered the revenue would amount to £34,218. The cost of all the works necessary to construct a reservoir, with pipes capable of delivering 10 million gallons per day, is estimated to be £350,000. The cost of up-keep and maintenance, rates and taxes, repayment of capital, and interest is estimated to amount to less than £20,000 a year. There would be a considerable profit to the Corporation if the figures should eventually be found to be in accordance with the estimates; but the Corporation will incur the risk of an enormous sum in the construction of the reservoir, and they should be entitled to some recompense. It is argued, moreover, that if the Merthyr Corporation allow any other authority to step in and construct a reservoir at Pontsticill, they would have to face very considerable difficulties in the event of the millowners demanding the repair of the Pentwyn dam. If in such circumstances the Corporation erected a new embankment above Pentwyn, they would not be able to build it sufficiently large to yield them anything but a loss, without interfering with the supply of water to the other authority's reservoir at Pontsticill. What has now been agreed upon has made the formation of a Water Board for the county a possibility. Water cannot be impounded more cheaply in South Wales that it can in Taff Vechan; and the quality of the water is soft.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The question of the illuminating power of the gas supplied in Edinburgh, and the provision of a new testing-station in the city, were under the consideration of a Sub-Committee of the Town Council last Wednesday. The Town Clerk made a statement, in which he pointed out that in the Act of 1888 it was provided that, six months after the passing of the Act, the Gas Commissioners were to name the place where, and the time when, the tests should be made. The places so named were Waterloo Place, Edinburgh, and Baltic Street, Leith. Some time afterwards, the Edinburgh testing-place was removed to New Street. When the Act was obtained for the acquisition of land at Granton for the new works, no alteration was made with regard to the testing of the quality of the gas; and at present the various testing-places are all at stations which had been selected independently of the way stated in the Act. Since the Act of 1888, the method of testing had been greatly improved; and yet in both Acts (subsequent) the old method had been retained. The Town Clerk suggested that, in connection with the proposed reduction of the candle power of the gas, if, as was stated, a lower candle power was more adaptable to modern fittings, and more economical for heating purposes, no opposition should be made to the application. He also suggested that the candle power should be ascertained by tests taken at a testing-place within the area supplied, and that power should be obtained that the tests should be taken according to the most modern methods; and also, as in the Glasgow Act, that provision should be made to adopt any other standard recognized by the Board of Trade. The Sub-Committee agreed to recommend that appliances be obtained for testing the quality (illuminating power) both of the gas and the electric light in the city, to be set up in a room in the City Chambers; the testing is to be done by the Inspector of Gas-Meters. These recommendations are to be submitted to the Lord Provost's Committee next week.

Now there is no doubt that the Corporation can establish a testing-place, for their own purposes, wherever they please. Any consumer can do this; and the Corporation are nothing more than consumers, in the eye of the law. They may seek powers, in any Act of Parliament which they promote, to test the gas for themselves; but it will be a new departure if Parliament should give them penalty clauses which would clash with the requirements they have already placed upon the Gas Commissioners. Parliamentary powers cannot be accorded to one consumer to test the gas where and when he pleases, and denied to other consumers. The Corporation of Edinburgh are not custodians of the gas supply; and if they should receive the power which is suggested, it could only be in their capacity of gas consumers. Therefore the same power would be necessarily and concurrently conferred upon every other consumer; and gas testing would be liable to be carried on in all sorts of places, irrespective of the conditions which are held to be essential. The Town Clerk's advice is based on a firm opinion that the most modern methods of testing should be adopted, which points to non-recognition of the fact that, with the incandescent burner, illuminating power is not now the aim of gas producers. But whether he be right or wrong in his views as to gas testing, it is a satisfaction to find that the Sub-Committee—upon whose initiative does not appear—have included in their recommendation the proposal that the illuminating power of the electric light supplied should also be tested. I have always regarded it as an anomaly that, whereas suppliers of gas should

be rigidly tied down to supplying an article of a certain illuminating power, suppliers of electricity should be allowed to give as much or as little light as they please. Electric current, applied to lighting, gives the same illuminating power at all times, if sufficient current be provided. If there is not current, the light is not obtained. Electric light consumers have the remedy in their own hands; they can take the light or leave it, as they choose. The transaction is a commercial one. The suppliers are not bound to give a certain light, and the consumers are free to take it if it suits them, or to decline to take it if they are not satisfied with it. Gas suppliers have not the same freedom. They cannot say: "Here is the light we supply. If you are pleased with it, we will be glad to give it to you; but if you are not pleased with it, you must find light elsewhere." They are tied down, in the alleged interest of the public, to supply a determined standard of light, and are subject to penalty if they do not. The question may be asked: If freedom be given in the one case, why not in the other? This Sub-Committee of the Corporation of Edinburgh seem to have some glimmering of reason upon this phase of the supply of artificial light to the community. If they obtain the powers which are suggested, and exercise them, they may secure results which will open the eyes of the community, and may possibly startle them, but which will certainly not be derogatory to the gas supply. But in this matter of testing the illuminating power of electricity, the Corporation are not in the same position as they are with reference to gas. They are themselves the suppliers of electric light. While they have, as yet, no *locus standi* in the matter of gas supply, they, and they alone, are responsible for the illuminating power of the electric light; and if they should obtain power to test it, and it should be found to be deficient, they would themselves have to bear the odium of not furnishing a service they were professing to give—probably to pay a penalty for their default—and, verily, their last condition would be worse than the first.

We had this afternoon a very useful visit by the members of the Western District of the Scottish Junior Gas Association to Tradeston Gas-Works, Glasgow, and a very fine attendance of the members. A description of the works is given in another column. They are a pointed illustration of the mutation of things in this world. Not very many years ago, they were the "crack" gas-works in Glasgow—having, upon reconstruction by the late Mr. W. Foulis, superseded the Dalmarnock works in this position. They only held it for a year or two, however, the extension of the Dawsholm works having placed them first. Now, for over three years, Dawsholm has been eclipsed by Provan. Tradeston is, in some respects, antiquated. It was there, however, that Mr. Foulis first put to the test his stoking machinery, which has attained such popularity among gas managers. It is one of the wonders of the Tradeston works that they were reconstructed with the intention of their being wrought by hand labour, and were so at first, but that when machinery was thought of it was found that there was sufficient room in the retort-house for it. It almost looks as if Mr. Foulis had a presentiment of the coming of machinery, and had prepared for its introduction. At all events, the retort-house is a palatial one, when compared with some which have been erected since. The works now fully occupy the site, leaving no room for extensions. They are not easy to operate (being cut in two by the main line of a railway, while the levels are not all that could be desired); but the disadvantages are not sufficient to prevent the Manager (Mr. A. Smith) from producing results which compare well with the other gas-works of the Corporation. In fact, to use Mr. Smith's own expression, that which is looked upon as a disadvantage is sometimes not so, but may really be a help to the manager, according to the way he works. It was in the Tradeston works that the diabolical attempt was made, in 1882, to plunge Glasgow into darkness by the blowing up of a gasholder with dynamite. The visitors were shown the spot where the deed was committed; but no trace of it is to be seen, though some of the patches upon other parts of the holder are visible. Mr. W. Glen, the foreman in the works, has a vivid recollection of that night. He tells of how he was set to the work of flooding the broken gas-main; the fear being that air would get into other parts of the plant and be the occasion of serious disaster. The work—a fearsome one—was successfully accomplished; but it is impossible, Mr. Glen states, for anyone who saw it to forget the awful sight of the burning oil and tar which were on the surface of the water in the tank. The broad expanse of the tank was a mass of flame, and nothing could be done to extinguish it, so it burnt out; but it took six or seven hours to do so. Perhaps the most wonderful part of the story is that one of the dynamitards is now employed in the works.

In the Greenock Town Council this week, the Gas Committee, by a majority, recommended that coke be not given to persons who may be in necessitous circumstances. The counter-proposal was that coke be sold to needy people at the price of 1d. per half bag. Mr. Forbes, the Convener of the Committee, explained that they had no coke to spare, but that, as a matter of fact, they could not supply the demand, as they had contracts to fulfil. The recommendation of the Committee was adopted by twelve votes to nine. Mr. Mitchell called attention to the number of stokers employed in the works at Inchgreen. There were now, he said, 25; and it was quite a common thing, before they had the stoking machinery, to have 45 or more. The wages paid to stokers in 1901—which might be said to be the last year when the stoking machinery was allowed to stand idle—were £3755; and in the year ending Dec. 31 last, they amounted to £1869, or a saving of £1886 by the introduction of stoking machinery. Bailie Bayley congratulated Mr. Mitchell on the success which had attended the introduction of the machinery. The smaller amount paid in stokers' wages is, however, scarcely a sufficient view to take, if the object be to make out that stoking machinery effects a saving in working costs, because stokers require no capital outlay, upon which interest has to be paid. There is also no depreciation to be allowed upon stokers, nor outlay for repairs. The subject requires to be looked at more deeply than Mr. Mitchell does.

The report of the Gas Committee, submitted at the last meeting of the Arbroath Town Council, stated that at a meeting of the Committee on Nov. 14, the Clerk presented the report by Professor Sutherland, of the University College, Dundee, and Dr. J. Keith Anderson, of Arbroath, of the *post-mortem* examination made by them upon the body of the late Mr. George Christie, and it was read; and the Committee resumed consideration of the communication from the firm of Law Agents intimating claims made against the Corporation in respect of their alleged responsibility for the consequences of the explosion at the gas-works on the morning of Sept. 27. The Committee, after consideration, agreed to remit to Provost Alexander, the Convener (Bailie Smith), and the Town Clerk, as a Committee, to ascertain if an arrangement could be made for the settlement of the claims without admitting liability. The Town Clerk reported that he had made inquiry as to the rate at which the Corporation could be insured against third party risks; and that it did not appear that unlimited liability was a risk which any of the Insurance Companies would accept. He had received a quotation for insurance covering a loss of £5000 in one year, or £2500 to cover the loss on any one accident, at the rate of £4 per 1000 of the population. The Committee were disposed to consider that it would be more advantageous that the Corporation should institute a fire insurance fund, than that they should pay any such premium as was implied by a rate of £4 per 1000 of the population; but as the Manager informed the Committee that he had heard of a case where an insurance of this kind was effected at a very moderate rate, it was remitted to him to obtain particulars. The Manager reported to the Committee, in accordance with the remit made to him, in October last, in regard to specifying a special price to be charged for gas used in engines, that he found only one consumer had used more than 250,000 cubic feet in an engine during the year. Another firm had, however, decided to add another engine of 15 H.P. to their plant; and they expected to use about 300,000 feet per annum. A special reduction in the price of gas for power to consumers of over 250,000 feet a year would therefore apply to two consumers only; and if a special rate for gas used for any trade purpose were adopted, complication was likely to arise. After conferring with the Convener, he suggested that any concession to be made should be only to large consumers. The Committee resolved that a rebate or allowance should be made for all gas consumed in engines, up to 250,000 cubic feet per annum, of 2½d. per 1000 feet—being the same as at present; and that each 1000 feet above 250,000 feet should be subject to a rebate of 5d. The Committee reserved for further consideration what rebate should be allowed for gas consumed with bunsen burners or for lighting. The Committee reported that, in their opinion, the claims by Mrs. Christie and family were of such a nature, as regarded amount and otherwise, that it would be advisable to have the opinion of eminent Counsel as to the extent of their liability before moving further in the matter. The adoption of these recommendations was unanimously agreed to.

A vigilant newspaper representative has discovered, and published the information, that the Commercial Section of the North British Association of Gas Managers (North-Eastern District) met at Cowdenbeath on Wednesday of this week; and that, after discussing matters relating to the industry, they visited the local gas-works, and made an inspection of the spiral-guided holder and the coal and coke handling plant, which the Gas Company were congratulated upon having.

Following, it is reported, a demonstration given by a petrol gas company in the Town Hall of Lochmaben the other night, the introduction of petrol gas into the burgh is to be fully considered. It was agreed that the hall was better lighted than it had ever been by coal gas. Provost Halliday remarked that Lochmaben and similar places could not supply coal gas at a price that would pay for its production; and therefore they were forced to turn to a light which could be made cheaper, and supplied to the community at something like the cost of lighting in the larger towns. Now, there is a good deal of the peradventure in this. There is no doubt that petrol gas, of high illuminating power, can be produced at a cheap rate; but what of its distribution by means of old pipes? For mansion houses, or clusters of houses, where every joint in the piping is perfect, it might be distributed without trouble; but in towns like Lochmaben, which has greatly decayed itself (the Gas Company following its fortunes), the presumption is that the distributing system is very much out of order. If this were the case, so much of the gas would be lost that the price to the consumer would not, in all probability, be very much less than that of coal gas. This view leaves out of account the carrying power of petrol gas, upon which there might be trouble.

Prepayment Meter Considerations.

Writing to the "Birmingham Daily Mail" on the subject of prepayment meters, Mr. C. L. Benbow says it is high time the Corporation took up the question of gas-meter thefts. He continues: "While the loss does not fall upon their shoulders, they appear to treat it in a very apathetic manner, instead of taking steps to protect the interests of their customers. These meters will always be easy prey to thieves so long as they are fixed in places where they are usually inadequately protected. It has occurred to me that the objects of the thieves might be defeated in a very simple manner; and I make the following suggestion, in the hope that it may commend itself to the proper authorities—viz., to provide prepayment meters with a detachable lock-up box, which could be slipped into the meter by the consumer when inserting pennies, and afterwards removed to a place of safety in the house. These boxes could be constructed in such a manner that the coins would drop in and yet could not be easily extracted. In fact, it would not be to the interests of the consumer to extract them, seeing that he would have to refund the money when the inspector called. There is another point in connection with this system which I consider requires adjustment. A man who has used a slot meter for a number of years has, undoubtedly, if he be an average consumer, more than paid the value of the stove and fittings loaned by the Corporation in the extra price paid for gas; and yet he is in no better a position than one who may start the system to-morrow. Could not a sliding-scale of feet of gas per penny be formulated, whereby an old consumer might be given advantage, which I think is his due."

Proposed Gas-Works Purchase at Chapel-en-le-Frith.—The Chapel-en-le-Frith District Council have decided to seek power to enable them to purchase the local gas-works, and to make and sell gas in the Chapel-en-le-Frith, Chinley, and Bugsworth district.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 25.

Sulphate of Ammonia.

Without any special feature, the market has been firm, with a hardening tendency towards the close. Fresh orders from abroad have not come forward freely, and the extra demand has been for completing the covering of the month's contracts. The closing quotations are £11 17s. 6d. to £11 18s. 9d. per ton f.o.b. Hull, £11 18s. 9d. to £12 per ton f.o.b. Liverpool, and £12 2s. 6d. per ton f.o.b. Leith. The forward position has also received more alteration, but, buyers being unwilling to pay any substantial premium on spot values, actual business has been limited. £12 per ton has, however, been paid, f.o.b. good port, for delivery over the summer months.

Nitrate of Soda.

This article remains quiet at 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality; and these prices would be accepted for delivery over the spring months.

LONDON, *Jan.* 27.

Tar Products.

The markets were practically unchanged during the past week—still remaining dull in most cases. Pitch is very quiet for prompt delivery. Business has again been done in the best makes upon the east coast at 20s. Continental consumers appear willing to consider business only for next season, but refuse to offer prices which are any inducement to sellers. Creosote is steady. For immediate delivery in London reasonable figures would be accepted; but for some period ahead makers have been offered good prices. Benzol, 90 per cent., is about the same. Business has been done in London at 8¾d.; and in the North at 8¼d. Benzol 50 90 per cent. and toluol are still quiet. Solvent naphtha continues to decline. Very low figures are said to have been accepted in the North; while business is reported at under 11d. in London. High-flash naphtha continues easy. Carbolic acid is neglected. Continental consumers refuse to offer more than 1s. 6½d. for 60's on the east coast. In crystals, business has been done at very low figures. Creosote salts and naphthalene continue firm.

The average values during the week were: Tar, 13s. to 17s., *ex* works. Pitch, London, 20s. 6d. to 21s.; east coast, 19s. 6d. to 20s.; west coast, 18s. 6d. to 20s., f.a.s.; Benzol, 90 per cent., casks included, North 8d. to 8½d., London 8¾d.; 50-90 per cent., casks included, North 8d. to 8¼d., London 8¼d. to 8½d. Toluol, casks included, North 9½d. to 9¾d., London 9½d. to 10d. Crude naphtha, in bulk, North 3½d. to 3¾d., London 3¾d. to 4d.; solvent naphtha, casks included, North 9½d. to 10d., London 10½d. to 11d.; heavy naphtha, casks included, North 10d. to 10½d., London 10½d. to 11½d. Creosote, in bulk, London 2⅞d. to 2¾d., North 2¼d. to 2⅜d. Heavy oils, in bulk, 3d. to 3⅛d. Carbolic acid, 60 per cent., casks included, east coast 1s. 6¾d. to 1s. 7¼d., west coast 1s. 6¼d. to 1s. 6¾d. Naphthalene, £6 10s. to £10 10s.; salts, 45s. to 47s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article is steady; and the firm tone continues. The principal London Gas Companies still quote £12 5s.; but outside makes are purchasable at £11 17s. 6d., though one of the very best was sold at £12 upon Beckton terms. In Hull, business has been done at £11 18s. 9d. for a good make. In Liverpool, business is reported at £12. In Leith, buyers refuse to offer over £12 2s. 6d.; but makers have very little to spare, and are independent.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The elements, and the generally satisfactory condition of the staple trades, continue to favour the coal trade of this part of the country. Reports from collieries in the Manchester and surrounding districts are uniformly on the side of ample business. Orders come in so fast that customers may be said to be clamouring for coal, and have some difficulty in getting their demands supplied. Engine fuel in particular is most urgently required. The prices remain unchanged in all sections on the basis of the September fixtures.

Northern Coal Trade.

There has been a strong demand for some kinds of coal, but for others the inquiry shows the dulness that is usual at this season, when the northern navigations are closed. Steam coal is naturally most affected; and the prices this week are occasionally lower. Best Northumbrians are from 12s. 6d. to 12s. 9d. per ton f.o.b., second-class steams from 11s. 9d. to 12s., and steam smalls from 6s. 6d. to 7s. The collieries are rather unequally situated; some having orders well booked into next month, and others being not so well placed. In the gas coal trade, there is a full inquiry, and the sterner weather, with some occasional fog, seems to have stimulated the consumption. For Durham gas coal, the prices vary with the quality, from about 12s. 3d. to 14s. per ton f.o.b. But a large contract for Sweden, which is expected to be tendered for shortly, may do something more towards defining the values. Coke is steady for furnace kinds; but gas coke seems weaker. For good gas coke, from 18s. to 18s. 6d. per ton f.o.b. is near the current quotation.

According to the "Iron and Coal Trades Review," the Copenhagen gas coal contract has been settled wholly in favour of Durham gas coals for shipment and delivery over the ensuing twelve months. Londonderry quality for shipment from Sunderland is allotted about 60,000 tons, at 17s. 9d. per ton, c.i.f.; Wearmouth gets the same quantity on similar terms; and Thornley is booked for 40,000 tons, Sunderland or Hartlepool shipment, at 17s. 6d. Some 5000 tons of Holmside or New Pelton coal, for shipment from the Tyne, are optioned at 16s. 3d. per ton, c.i.f. The business, as usual, has been worked through the Danish Coal Company at Copenhagen.

Scotch Coal Trade.

The market is reported to be quiet. There is no improvement in shipping; the most that can be said of the business being that it is steady, with a not very brilliant outlook. The prices quoted are: Ell 12s. 6d. to 14s. per ton f.o.b. Glasgow, splint 13s. 6d. to 14s., and steam 12s. 6d. to 12s. 9d. The shipments for the week amounted to 216,520 tons—an increase of 72,775 tons upon the previous week, but a decrease of 29,887 tons upon the corresponding week of last year. For the year to date, the total shipments have been 468,091 tons—a decrease of 61,919 tons upon the corresponding period of 1907.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 218.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19½—20½	..	5 2 5
268,324	"0	,,	7⅛	Do. 7 p.c.	14—15	..	5 0 0
310,000	Stk.	Jan. 16	4	Do. 4 p.c. Deb.	97—99*	..	4 0 10
200,000	5	Oct. 30	7	Bombay, Ltd.	6¼—6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½—5	..	5 12 0
50,000	10	Aug. 29	14	Bourne- mouth Gas and Water	10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7		B 7 p.c.	16¼—17	..	4 2 4
53,200	10	,,	6		Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated		247—252	+2	4 19 2
300,000	,,	,,	9½	Do. New		185—190	+2	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.		120—125	..	4 0 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.		100—105	+2	3 16 2
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.		203—210	..	5 7 1
246,320	,,	,,	8½	Do. A. Ord. Stk.		153—158	..	5 4 5
460,000	20	,,	10	British		41⅛—42½	+1	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.		118—121	..	4 19 2
165,700	,,	,,	4½	Do. do. 3½ p.c.		88—91	..	4 18 11
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.		11—11½	..	6 1 9
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.		90—92	+1	4 7 0
150,000	20	July 12	8½	Cagliari, Ltd.		26—27	..	6 2 3
100,000	10	—	—	Cape Town & Dis., Ltd.		6—8	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.		7—9	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.		48—50	..	6 0 0
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.		92—94	..	4 15 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.		108—110	..	4 10 11
1,443,280	Stk.	,, 29	5⅝	Commercial 4 p.c Stk.		104—109	+1	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.		101—106	..	4 14 4
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.		81—83	+1	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.		106—111	..	5 17 1
200,000	,,	,,	7	Do. 7 p.c. Pref.		135—140	..	5 0 0
460,170	Stk.	—	5½	Derby Con. Stk.		122—123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.		103—105	..	3 16 2
148,995	,,	—	—	East Hull 5 p.c. Ord.		101—104	..	—
486,090	10	July 31	12	European, Ltd.		22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid		16⅜—17⅜	..	5 2 10
15,181,590	Stk.	Aug. 15	4 5/16	Gas- light and Coke	4 p.c. Ord.	68—99	+½	4 8 11
2,600,000	,,	,,	3½		3½ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4		4 p.c. Con. Pref.	103—106	..	3 15 6
4,193,975	,,	Dec. 13	3		3 p.c. Con. Deb.	82—84	+1	3 11 5
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.		93—98	..	5 2 0
82,500	,,	,,	6¼	Do. do. 5 p.c.		114—117	..	5 11 1
70,000	10	Oct. 11	11	Hongkong & China, Ltd.		19—20	..	5 10 0
4,940,000	Stk.	Nov. 14	8	Imperial Continental		179—182	+1	4 7 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.		93—95	+1	3 13 8
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.		115—120	+2½	5 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
306,083	Stk.	Dec. 30	4	L'rpool Unit'd Deb. Stk		106—108	..	3 14 1
561,000	,,	Aug. 29	10	Liverpool United A		222—224	..	4 9 3
718,100	,,	,,	7	Do. B		162—.64	+4	4 5 4
152,736	Stk.	Feb. 14	7⅜	Maidstone 5 p.c.		140—145	..	5 5 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd.		4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of Melbourne	5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½		4½ p.c. Deb.	101—103	+1	4 7 5
541,920	20	Nov. 14	3½	Monte Video, Ltd.		10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.		107—108	—½	4 5 8
406,025	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.		86—88	..	3 19 7
15,000	10	Aug. 29	10	North Middlesex	10 p.c.	15½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.		13—14	..	5 0 0
300,000	Stk.	Nov. 28	8	Oriental, Ltd.		135—138	..	5 15 11
60,000	5	Sept. 13	7	Ottoman, Ltd.		6—6½	..	5 7 8
398,490	5	Oct. 30	7	Primitiva Ord.		6⅜—7⅜	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.		4⅜—5⅜	..	4 17 7
488,900	100	Dec. 2	4	Do. 4 p.c. Deb.		93—95*	+1	4 4 3
1,000,000	10	Oct. 11	8	River Plate Ord.		13⅜—14	..	5 14 4
312,650	Stk.	Dec. 30	4	Do. 4 p.c. Deb.		93—95	+1	4 4 3
250,000	10	Sept. 27	8	San Paulo, Ltd.		13—13⅜	..	5 18 6
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.		49—51	+2	4 18 0
135,000	Stk.	Sept. 13	10	Sheffield A		244—246	..	4 1 4
209,984	,,	,,	10	Do. B		244—246	..	4 1 4
523,500	,,	,,	10	Do. C		244—246	..	4 1 4
70,000	10	Nov. 14	10	South African		14½—15½	..	6 9 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.		123—126	..	4 7 4
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.		82—84*	+1	3 11 5
201,720	Stk	Sept. 13	8	South Shields Con. Stk.		154—156	..	5 2 7
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.		118—121	+1	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.		120—123	..	4 1 4
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.		120—125*	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.		104—109	..	4 11 9
120,000	Stk.	Aug. 15	6⅜	Tottenham and Edmonton	A 5 p.c.	120—123	..	5 9 9
398,940	,,	,,	5¼		B 3½ p.c.	100—103	..	5 1 11
149,470	,,	Dec. 13	4		4 p.c. Deb.	97—100	..	4 0 0
182,380	10	Dec. 30	8	Tuscan, Ltd.		10¼—10¾	..	7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		95—100	..	5 0 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.		107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- worth and	A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6⅜		B 3½ p.c.	128—133	..	4 17 9
75,000	,,	,,	5⅜		C 3½ p.c.	—	..	—
80,075	,,	Dec. 30	3	Putney	3 p.c. Deb. Stk.	73—73	..	3 16 11
845,872	,,	Aug. 15	5⅜	West Ham 5 p.c. Ord.		101—104	..	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.		118—120	..	4 3 4
228,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.		102—107	..	3 14 9

Prices marked * are "Ex div."

Cardiff Water Consumption.

In his report for 1907, which was presented to the Cardiff Water Committee last week, Mr. C. H. Priestley, the Water Engineer, stated that during the year 12,328 drawing taps had been repaired; and these, if charged for at 1s. each, would amount to a sum of £616 8s.—much more than the wages paid to the whole of the waste inspectors. The total consumption was 2,175,850,000 gallons. The average consumption per day throughout the year was 5,961,233 gallons, or 27·34 gallons per head per day on an estimated population of 218,000. The maximum supply was on July 19, when 7,510,000 gallons were used, or an average of 34·45 gallons per head; and the minimum supply was on March 10, when 3 940,000 gallons were used, or an average of 18·07 per head. The rainfall at the Beacons for the year was 86·92 inches, and the mean for the past 23 years was 76·06 inches; while that at Lisvane was 40·88 inches for the year, and the mean for the past 44 years was 39·33 inches. The consumption for trade and municipal purposes last year was about 11 gallons per head, so that the domestic consumption throughout the area of supply was 16 gallons per head per day, which, the report stated, would compare favourably with all large cities and towns, especially when Cardiff's excellent sanitary arrangements were taken into consideration, and it was remembered there was no charge for baths as in most places. The revenue for the year ending March last was £70,550, which was £3500 more than the previous year.

Explosions in Electric Light Boxes at the West End.

Last Sunday evening, a series of explosions occurred close to Hyde Park Corner, causing some damage. The area affected was Hamilton Place (the short thoroughfare which runs from Piccadilly into Park Lane), and for a time considerable excitement prevailed, as the police formed a cordon across the street, and diverted the omnibus and other traffic which customarily passes this way to the Marble Arch. It appears that a short-circuit in the switch in an electric distributing-box first caused a slight fire at No. 2 Hamilton Place. The alarm was given directly the report was heard, and a Superintendent of Police from Manchester Square arrived with the men from his station, who did all that was necessary by the use of a first-aid appliance. Before the firemen had made preparations for leaving, a second and more serious explosion occurred under the pavement immediately outside the mansion of Mr. Leopold de Rothschild. A manhole cover was blown out, and the force spent itself in wrecking a portion of the doors and windows in the basement of the house; but, fortunately, no case of personal injury occurred. Shortly afterwards a third explosion took place at an intermediate manhole, from which a tongue of flame shot into the air to a height of a dozen feet or more. There were also indications of a fire at a manhole on the other side of the road; but this did not prove to be serious. The electric current was at once cut off, the result of which proceeding was the extinction of all the lamps in Hamilton Place, while the men were examining and testing the street manholes.

Gas Supply for Lyndhurst.

The Directors of the Southampton Gas Company have resolved to lay mains to supply Lyndhurst with gas, as soon as may be practicable after they have obtained a suitable site for the erection of the necessary distributing holder. The price of the gas supplied to the ordinary consumers in the Lyndhurst district will be 4s. 6d. per 1000 cubic feet. Negotiations for the purchase of a suitable piece of land have been in progress for some time; but obstacles have hitherto prevented the purchase being completed. Renewed efforts are, however, now being made in other directions to surmount the difficulty. The scheme will require the laying by the Company of a trunk main 6 miles long, without taking into account the necessary side street mains. The proposal to charge 4s. 6d. per 1000 cubic feet has caused some of the inhabitants to regard the matter unfavourably.

Bursting of the Plymouth Water-Main.

The wisdom of the policy pursued by the Plymouth Corporation in deciding to duplicate the trunk main on which the supply of water to the town depends was demonstrated during the recent frost. On the 6th inst., when the Devonport leat was frozen up, and the borough as well as Plymouth was drawing upon the Plymouth water supply, the trunk main burst at Roborough, some 4 or 5 miles from the two towns. In consequence of this, the supply to Devonport had to be discontinued, and Plymouth itself was threatened with a shortage of water. Until steps could be taken to replace the fractured main, water was sent through it; and though the loss by leakage was great, some of the water reached the service reservoirs. At the same time, water was also sent through the leat, which had been disused for twenty years, and leaked very badly, but which it was hoped to make available if other means of supply failed. By the 11th inst., it was found possible to take in hand the repair of the broken pipe; and the supply was then continued. Referring to the matter at a meeting of the Plymouth Town Council, Mr. Tozer (the Chairman of the Water-Works Committee) said that the duplication of the mains which was in progress had not begun a moment too soon. The service reservoir at Hartley contained, at most, not more than thirty hours' supply for the town, and none which could be supplied to customers of the Corporation in outlying districts. Mr. Tozer added that, owing to the exceptionally low price of iron pipes, the Engineer (Mr. F. Howarth) estimated that the cost of duplicating the main would be £13,317, instead of £15,500, which was asked for originally.

The Incandescent Supply Agency, Limited, has been registered in Edinburgh with a capital of £3000, in £1 shares, to carry on, in the United Kingdom or elsewhere, the business of manufacturers of, agents for, and dealers in, gas and electric light fittings, or other accessories, novelties for illumination, &c.

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The Greenwich Boiler Explosion.

Rather more than a year ago, a terrible explosion occurred at the generating station of the South Metropolitan Electric Light and Power Company at Greenwich, resulting in the destruction of the building and machinery, and involving the loss of two lives, besides injuries to several men. The station is in proximity to the works of the South Metropolitan Gas Company, and a singularly narrow escape was experienced by a number of men working on the premises. They were standing close by the wall when the explosion occurred, and all ran from the spot as fast as they could. In a few seconds the wall was hurled down by the force of a thermal storage drum, which, after passing through three brick walls (the third being 2 feet thick), fell within a few feet of the man on the Gas Company's premises, 95 yards distant from the origin of the explosion. An inquiry into the matter has been conducted, on behalf of the Board of Trade, by Mr. A. A. Hudson, Barrister-at-Law, and Mr. J. H. Hallet, Consulting Engineer, who last Wednesday delivered their judgment. They found that the plate was of good normal quality, but that a drum had been supplied with a defective end plate, which was injured by rough handling due to bad workmanship. The firm who made the plate were exonerated; but the suppliers of the drum, as well as their Manager, were held responsible, and were ordered to pay £400 and £50 respectively towards the costs and expenses of the inquiry. There was no suggestion of responsibility against the Electric Lighting Company; but their Chief and Resident Engineers were considered blameworthy, and were ordered to pay £50 and £30. The Commissioners concluded their report by stating that nothing had occurred during the inquiry to throw any doubt upon the safety of thermal storage drums.

Belfast Gas-Works Extension Scheme.—The business on the *agenda* at the last meeting in committee of the Belfast City Council included the consideration of the proposed appropriation of a portion of the Ormeau Park for the purpose of an extension of the gas-works; but Mr. J. A. Doran, the Chairman of the Gas Committee, said he had not yet been supplied with all the information he required to enable him to make his introductory statement, and, in addition, five new members of the Corporation had been added to his Committee since the municipal elections. Under these circumstances he asked the Council to postpone consideration of the matter to a later date, in order that he and the reconstituted Committee might have an opportunity of discussing the points at issue. It was a matter of such serious importance, that he thought it was only fair they should have the chance of conferring together and coming to some conclusion before the question was discussed by the Council. Ultimately, the following resolution was passed: "That when the Gas Committee have a definite scheme prepared, a special meeting of the Council be called to discuss the proposed extension of the gas-works; and that Standing Order No. 14, dealing with the duration of speeches, be suspended for that occasion."

Disputed Meter Registration.

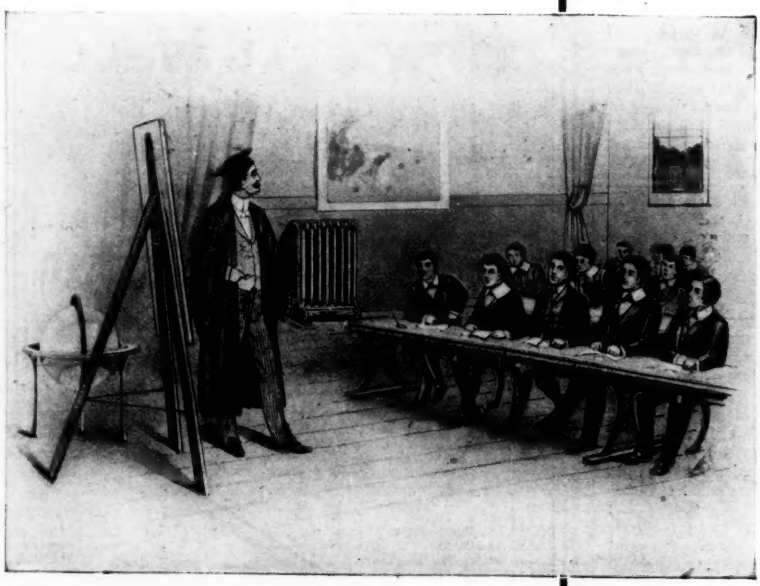
At the Edmonton County Court last Wednesday, before His Honour Judge Tindal Atkinson, the Enfield Gas Company sued a dairyman named Peck, of Bush Hill Park, for £4 16s. 4d. for gas supplied during the quarter ended the 21st of March last. Defendant disputed the accuracy of his meter, and paid £2 1s. 9d. into Court. Mr. Windsor, who appeared for the Company, gave the figures of the quantity of gas consumed by the defendant during the year ended September last as follows: September to December, 1906, 4100 cubic feet; December to March, 28,800 cubic feet; March to June, 6200 cubic feet; June to September, 6700 cubic feet. It was the great difference between the figures for the second quarter and those for the other quarters that led the defendant to question whether or not the meter was correct. He had, however, refused an offer to have the meter tested. John Foster, the Company's index taker, said he noticed the additional quantity of gas recorded for the December to March quarter, and reported it to the Company, and the meter was removed. Alexander Woodfield, the collector, said the Company offered to have the meter tested at the London County Council's station, if the defendant would contribute 2s. 6d. towards the cost—the amount to be refunded if the meter were found to be faulty; but he would not agree to this. Mr. W. Thomas, the Chief Inspector, said that immediately after the meter was taken from the defendant's premises it was tested in the Company's shop, and found to be correct; and it was then fixed in the house of another consumer. The defendant said that never before or since that quarter had the meter registered so large a consumption of gas. His Honour gave judgment for the Company.

Blowing Out the Gas.—A young servant was found dead at her employer's house last week, as the result of coal-gas poisoning. The evidence at the inquest showed that the girl had only entered service the previous day. Her mistress, knowing she had had no previous experience with gas, showed her how to turn it out; but on waking in the morning, the mistress noticed a strong smell of gas, and going to the girl's room found the gas out, but turned full on. She said her belief was that the girl had blown the gas out. A verdict of "Accidental death" was returned.

A Water Scheme to be Suggested for Diss.—A short time ago, the Diss Urban District Council unanimously declined an offer made on behalf of a Company to lay mains in the public roads for the purpose of providing a water supply; but the need for a supply of some sort seems to be now generally recognized, for they have themselves decided to engage an Engineer to advise them as to a scheme, and the probable cost. It appears that on this occasion the question came up for consideration consequent upon the presentation of an influentially-signed memorial urging the Council to provide a supply. It was stated in the Council that many houses were without any water at all; while in others the supply was of a questionable character.

RADIATOR PICTURES

(continued).



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Sale of Shares.—At Camborne last Tuesday, 65 "B" shares of £10 each, fully paid, in the Camborne Water Company were sold by auction at from £12 17s. 6d. to £13 each. On the same occasion, two 4 per cent. debentures of £100 each in the Camborne Gas Company were disposed of at par; while ten shares in the Company realized £5 6s. 3d., and ten £5 shares, £4 10s. paid, in the Hayle Gas Company, fetched £4 8s. 9d. each.

Death in the Sheffield Gas Office.—Last Wednesday, at the Gas Offices, Commercial Street, Sheffield, Mr. Wilfred Hayes, the Chief Clerk of the Fittings Department, fell dead while conversing with a fellow clerk. He had been in poor health for some time; but that morning he said that he was much better. However, he suddenly collapsed; and before medical aid could be summoned, death took place. Mr. Hayes had been in the service of the Company for a considerable number of years.

Glastonbury Gas and Water Supply.—A Local Government Board inquiry has been held at Glastonbury with reference to an application by the Town Council for sanction to borrow £3000 for the gas undertaking and £1000 for the water-works. The Gas Manager (Mr. D. E. Garlick) explained that, of the former amount, £1500 was for mains and £1000 for cookers and meters. The loan for the water-works is needed for an extension of the high-level main from Northover to Beckery, and other purposes.

Street Lighting in Newcastle.—The Lamp Inspector for the Newcastle-on-Tyne Corporation (Mr. George Lamb) estimates the cost of public lighting for the ensuing year as follows: For gas lighting, £23,486 11s.; for electric lighting, £6036 13s.—total, £29,523 4s., as against £28,261 10s. for the previous year. It is proposed to erect 495 new lamps; making a total of 10,842 lamps, including 870 electric lights. Last year the number of gas-lamps was 9813, and of electric lights 837, or a total of 10,650.

Use of Lead Pipes with Soft Water Supplies.—The "Medical Press," commenting on the recent death from lead poisoning at Ravensthorpe (*ante*, p. 120) says: "Yorkshire figures largely in the history of lead-poisoning from drinking water; and it is difficult to understand how any sanitary authority alive to its responsibilities could permit the use of lead pipes for a moorland water supply. We are quite of opinion that the Legislature would be justified in putting an end to the practice once and for all. Possibly the day may come when lead will be excluded from all contact with drinking water."

Fresh Issues of Capital.—Our readers will see, from announcements appearing elsewhere, that Mr. Alfred Richards will resume next Tuesday, at the Mart, Tokenhouse Yard, his sales of stocks and shares of gas and water companies. On this occasion, he will offer, by order of the respective directors, a new issue of 350 £10 preference shares (5 per cent.) and a like number of ordinary £10 shares (7 per cent.) in the Aldershot Gas and Water Company; and £5000 of "C" capital (7 per cent.) of the Chichester Gas Company. The sale will include £800 of consolidated ordinary "A" stock of the Brighton and Hove General Gas Company, which Mr. Richards will submit for competition under instructions from Trustees.

Lamplighters' Wages at Bradford.—A minute of the Gas Committee refusing an advance of wages to the lamplighters has been referred back to them by the City Council; the argument for this course being that it was seven years since they had had an increase, and during this period the price of commodities had gone up 16 per cent. On the other hand, however, it was pointed out by Mr. Geldard, Chairman of the Committee, that the lamplighters worked from 42 to 47 hours a week; received wages of 24s.—some of them getting 25s.; had a topcoat supplied; and got ten days' holiday, for which they were paid. They could still earn money at window cleaning; and it was "all bosh" to suggest that they could not get proper sleep.

Progress of the Lancaster Gas Undertaking.—As evidence of the success of the Lancaster gas undertaking since it has been in the hands of the Corporation, it may be mentioned that the works were purchased in 1880 at a cost of £90,000, and that the total expenditure up to date has been £138,849. A sum of £29,531 has been credited to the redemption account; and £10,057 to the reserve fund. The capital debt was increased by the conversion of 4 per cent. irredeemable stock into 3 per cent. redeemable stock, and the erection of an additional tank and gasholder. Other plant has been paid for out of surplus profits or charged to the revenue account. The coal carbonized in 1880 was 4928 tons, and the quantity of gas manufactured was about 51 million cubic feet. Last year 20,470 tons of coal were carbonized, and 206 million cubic feet of gas made. The price in 1880 was 4s. 6d. per 1000 cubic feet, whereas now it is 2s. for private lighting, and from 1s. 6d. to 1s. 11d. for motive power. No charge is made for gas used for the public lighting, and meter-rents have been abolished since 1889. The Gas Engineer to the Corporation (Mr. Charles Armitage) has been chiefly responsible for the excellent progress made.

Gas v. Electricity for School Lighting.—The Chertsey School Managers have come to a wise decision on the matter of lighting. At a special meeting, the question of the supply of electricity to the new schools had been raised; the Woking Electric Supply Company, having given an undertaking to extend their mains to the town in six months. The Clerk at last week's meeting read two letters from the architects dealing with the matter. They said that the cost of the installation of electricity was estimated at £150, and of gas at £112; while the cost of consumption was in proportion of 27 to 15 in favour of gas. They added, however, that if the teachers and caretaker could be got to carefully attend to the switching off of electricity, this method of lighting should not prove very much dearer than gas. Mr. H. J. Hamilton, the Manager to the Chertsey Gas Company, wrote stating that the Company were adding a high-pressure plant to their works, and that he should be pleased to show what could be done by inverted burners. Mr. White, the Clerk of the Works for the new schools, expressed the opinion that the modern method of lighting by gas was softer and better for the eyes than electricity. After further discussion, it was decided to ask the County Council to instal gas throughout the schools.

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Woolmer and District Gas Supply.—The Headley (Hants) Parish Council have assented to the Provisional Order which has been applied for to sanction the establishment of gas-works at Woolmer, provided that the road lighting in the military camp is defrayed by the Government; and the promoter's Solicitor (Mr. Downie) has promised that a clause to this effect shall be inserted in the Order. The parishes of Alton, Selborne, and Kingsley have also approved of the scheme.

Portadown and Banbridge Water Supply.—Mr. P. C. Cowan has held a Local Government Board inquiry at Portadown regarding an application made by the Portadown and Banbridge Joint Water Board for a supplemental loan of £8000 to complete the scheme for supplying both towns with water from the Mourne Mountains. A sum of £70,000 has already been sanctioned for carrying out the works. In the course of the proceedings, the Inspector said he thought the Board had done very well; they had good works, and an excellent water supply. He understood that the people were delighted with the water; and in his opinion it was one of the best schemes in Ireland.

Consumption of Water in Manchester.—The average quantity of water supplied per day last year in Manchester was 38,337,116 gallons. Of this, 21,273,143 gallons came from Longdendale and 17,063,973 gallons from Thirlmere. In 1906, the daily supply averaged 37,016,113 gallons. Ten years ago, the figures were 28,812,954 gallons; while in 1855 the average per day was only 8,078,152 gallons. The average rainfall at Thirlmere was slightly above the average of the past 31 years; being 87·2 inches, against 86·6 inches. In some of the gathering-grounds, the fall was exceptionally heavy; and in one case—Ullscarf—it reached 107·2 inches. Last year's average was 3 inches more than in 1906, and was the highest since 1903, when it was 127·4 inches.

Visit of Edinburgh Water Trustees to Tonbridge.—Last Wednesday, a deputation composed of members of the Edinburgh and District Water Trust visited Tonbridge in order to inspect and inquire into the working of the new mechanical filtration plant, under the patent of Messrs. Bell Bros., recently put down by the Water Company. The deputation were given a very hearty welcome by the Chairman (Mr. J. Fagg) and the Directors; and they all showed a keen interest in, and appreciation of, the working and washing-out arrangements, and the detailed description of the plant's capabilities by the Engineer and Manager (Mr. James Lees) and Mr. Bell. After partaking of light refreshments provided by the Directors, Bailie Forest, in the name of the deputation, thanked them for their kind welcome. He remarked that in Edinburgh they brought water from a distance of 40 miles into the city, and their filtration system was not able to cope with the greater quantities they now obtained; and their desire was to introduce filter-beds and move with the times. He personally was, and he believed his colleagues all were, delighted that they came to Tonbridge, because they had been afforded the opportunity of seeing Mr. Bell's filters; and the condition of the water was very conclusive proof of their usefulness. In conclusion, he expressed the hope that they would have every prosperity with their scheme in Tonbridge, and in the town generally.

Gas Consumption in Scarborough.—The annual tea and concert of the men employed by the Scarborough Gas Company took place at the Albemarle Hotel last Wednesday, under the presidency of Mr. Alexander Allan, the Manager and Secretary, who was supported by Alderman Pirie, Mr. Smith (Sub-Manager), and Mr. Atkinson (foreman). In the course of the evening, Mr. Allan expressed his pleasure at meeting the men and their wives and families. He thought the Company were well served by their workmen. The industry in which they were interested was progressing by leaps and bounds; and in Scarborough they did not lag behind. A curious fact, having regard to the bad season, which was generally complained of, was that in July and August last the largest increase in the consumption of gas in Scarborough was recorded; and if visitors had not been there the gas would not have been used. That the gas industry was in so satisfactory a condition was a matter of moment to the housewives present, for it meant that wages would be regular. Alderman Pirie remarked that such a gathering as the present drew masters and workers together, and created a good understanding. Alluding to the success of the Company, he said he considered it was largely due to Mr. Allan and the staff. The concert programme, which had been arranged by Mr. H. H. Fenby, was judiciously varied, and it afforded much enjoyment. A pleasant entertainment was brought to a close with votes of thanks to the Chairman, Mr. Fenby, and those who had taken part in it.

A tender by Messrs. Willey and Co., of Exeter, for £2573, for a new retort-house for the Budleigh Salterton Gas Company, has been accepted, and progress is being made with the work.

The Horsham Urban District Council have declined to support the movement initiated by the Hastings Town Council for the purpose of securing powers for local authorities to wire premises for electric light, and to supply fittings, &c., on the ground that such powers would interfere with private traders.

We learn that the scheme for the improvement of the public lighting of Heaton Norris is now settled, so far as the selection of the lanterns is concerned; and that, in competition with five other samples of the best makers, the "Caxton" lantern, supplied by Mr. William Edgar, of Hammersmith, has been adopted.

While Mr. W. Collins, the Porthcawl Gas Manager, was tapping a gas-main some days ago, he was overcome by the fumes. Artificial respiration was resorted to by those who were with him, and a doctor was summoned; and under his direction the exertions for restoring animation fortunately proved ultimately successful.

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COMMERCIAL GAS COMPANY. Cannon Street Hotel. Feb. 27, Twelve o'clock.
GASLIGHT AND COKE COMPANY. Chief Office. Feb 7, Twelve o'clock.
TOTTENHAM AND EDMONTON GAS COMPANY. Chief Office. Feb. 15, Three o'clock.

Stocks and Shares.

ALDERSHOT GAS AND WATER COMPANY. Feb. 4.
BRIGHTON AND HOVE GAS COMPANY. Feb. 4.
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